SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

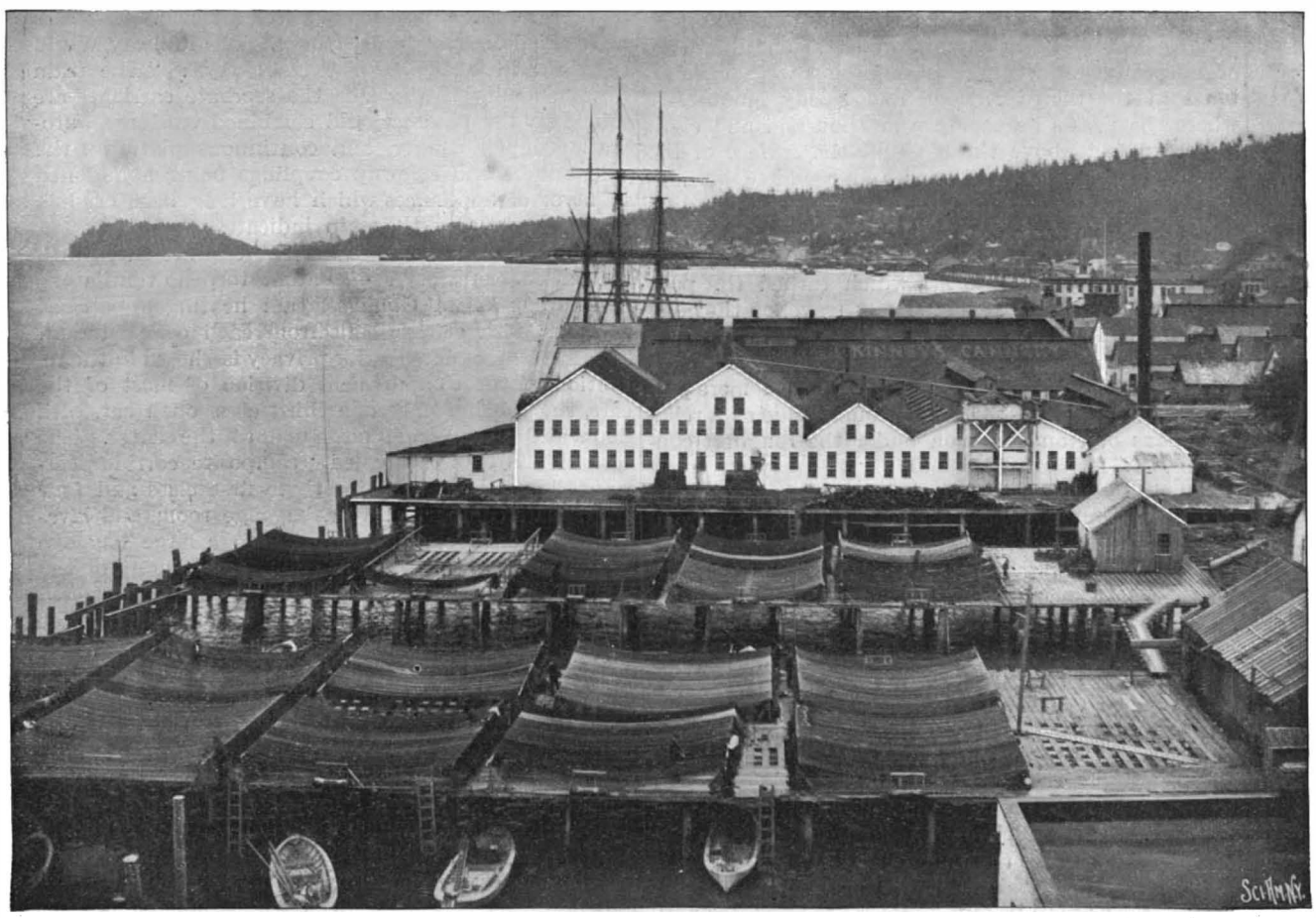
Vol. LXXV.—No. 12. ESTABLISHED 1845. NEW YORK, SEPTEMBER 19, 1896. $3.00 A YEAR. WEEKLY.

THE COLUMBIA RIVER SALMON FISHERIES.

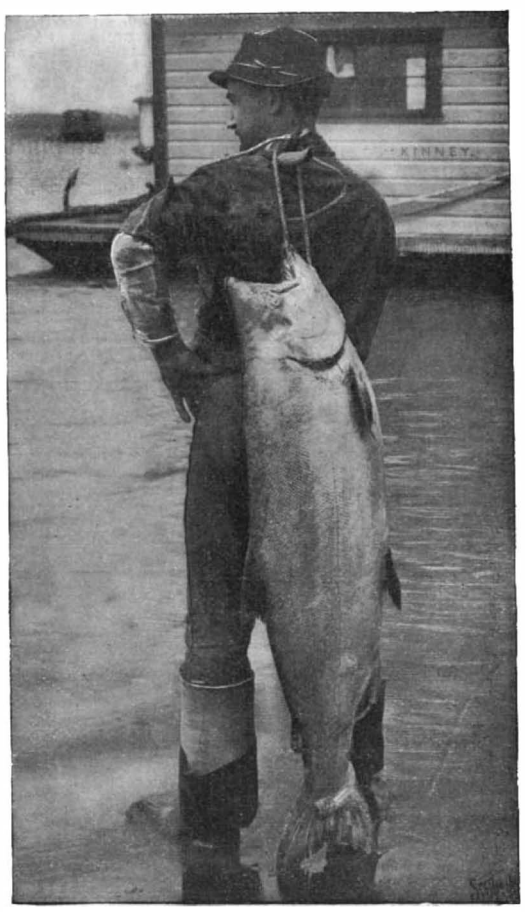
Among the many remarkable panoramas of natural scenery which unfold themselves to the traveler through the great Northwest, there is nothing to surpass that which is seen from the overland train as it winds its way through the great gorge of the Columbia River. The first view of this noble river—the Rhine of America—as it rolls onward between beetling cliffs, whose height is measured by the thousand feet, is stamped upon the memory with an impression of mingled awe and beauty which can never be effaced. At a point some one hundred miles from the mouth of the river the train turns sharply to the left and runs into the city of Portland. This, the capital of the Northwest, is situated on the banks of the Willamette, a tributary stream which drains the fertile and famous valley of that name. To reach the Pacific Ocean the traveler will take one of the fleet stern wheel steamers, which will carry him down the last one hundred miles of the Columbia, and land him at the thriving city of Astoria, the headquarters of the justly celebrated salmon fisheries. Astoria owes its existence to the enterprise of John Jacob Astor, who, early in the century, dispatched a double expedition, one by ship round Cape Horn and the other overland from St. Louis, across the then unexplored deserts and mountains, to found a trading post at the mouth of the Columbia River, for the collection of furs, pelts, etc. The place was named after the famous merchant; and in spite of the fact that even to this day it is without any railroad connection with the rest of the world (though one is now under construction), its advantageous location at the mouth of a great waterway, coupled with the rich natural resources of the surrounding country, have caused it to grow to a city of 10,000 inhabitants.

Astoria owes much of its importance to the fact that it is the meeting place of river and ocean traffic, being the port of call for the fleet of ships which carry the

(Continued on page 232.)



A COLUMBIA RIVER SALMON CANNERY—DAILY CAPACITY, 60,000 CANS.



A 65 POUND ROYAL CHINOOK SALMON.

SEINING—THE HAUL.

THE COLUMBIA RIVER SALMON FISHERIES.

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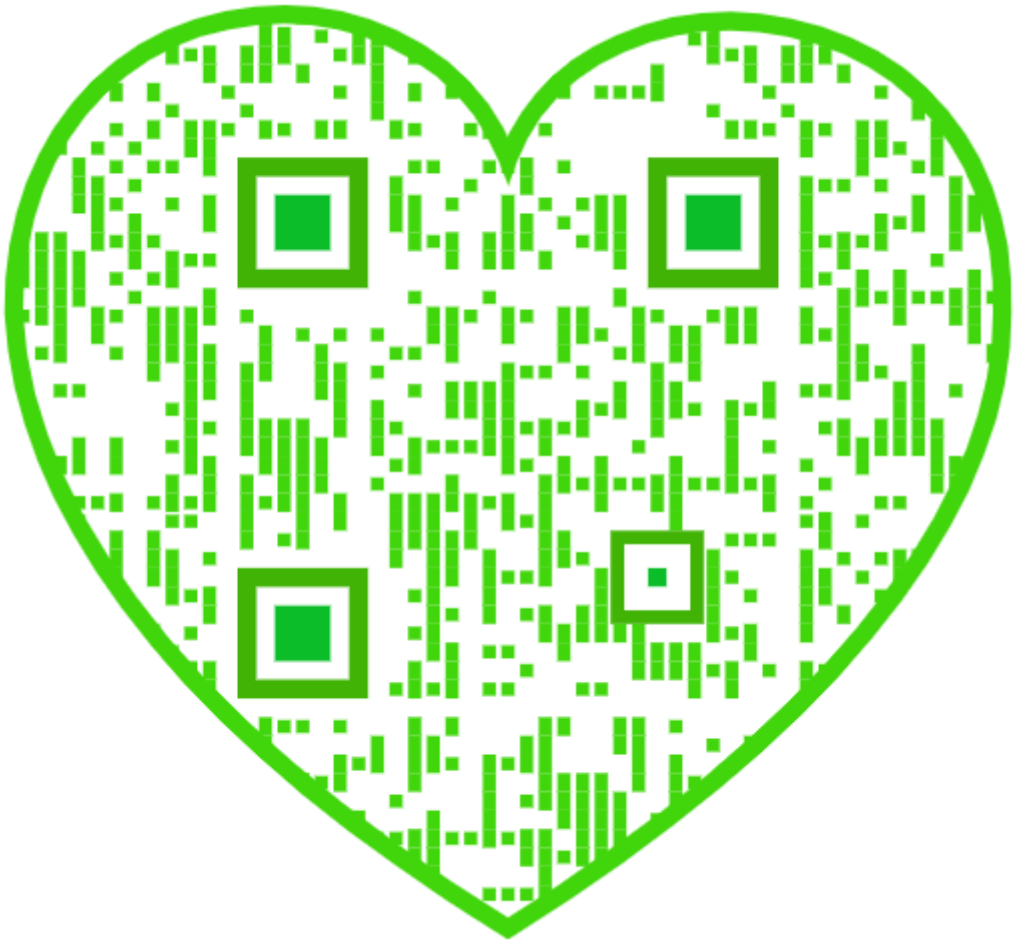

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

TERMS FOR THE SCIENTIFIC AMERICAN.
(Established 1845.)

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union 4 00

Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

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(Established 1876.)

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

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NEW YORK, SATURDAY, SEPTEMBER 19, 1896.

Contents.

(Illustrated articles are marked with an asterisk.)

American Association meeting, the 231
Archæological news..... 234
Balloon experiences, war..... 232
Bicycle gears, comparative*..... 239
Bicycles and good roads 230
Bicycle prices in England..... 235
Bicycle race, a transcontinental. 238
Bottle, the magic*..... 239
Buildings, measuring interior of. 231
Calumet and Hecla copper mine* 236
Car, the American, in England... 230
Car truck, ball bearing, O'Byrne's* 234
Cold storage, natural..... 235
Cyclone in Paris..... 238
Dam, the Genesee, project..... 234
Engines, large mining*..... 236
Exhibition, industrial, Berlin*... 233
Fire losses in 1895..... 240
Fish wheel for catching salmon.* 232
Fluorescent screen for X rays... 235
Frogs and beetles (6954)..... 241
Goode, Dr., death of..... 231
Houses, country, and wells..... 235
Ink, Japan (6956)..... 241
Li Hung Chang at Niagara..... 231
Mine timbering, heavy*..... 236
Motocycle race, the Providence. 234
Niagara River, geology..... 231
Palmieri, Prof., death of..... 231
Patent and trade mark decisions 235
Railway, a single rail, Lartigue system*..... 237
Railway fares, street..... 235
Rinderpest, danger of, in America..... 240
Russian purchases of machinery 232
Salmon fisheries, Columbia River*..... 229
Science notes..... 234
Scientific literature catalogue... 230
Shipping, inland, German..... 230
Shoe and leather trades, inventions in..... 238
Steamer, the largest merchant.. 234
Tattooing, origin of..... 236
Telegraphing, Chinese..... 238
Tooth brush, curiosities of the.. 233
Tuberculosis..... 236
Tzac Pokama, Guatemala..... 231

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 1081.

For the Week Ending September 19, 1896.

Price 10 cents. For sale by all newsdealers.

PAGE

I. CHEMISTRY.—A Completed Chapter in the History of the Atomic Theory.—By EDWARD W. MORLEY.—Conclusion of this classic paper on Proug's law and its definite disproof..... 17280
The Inspection and Sanitary Analysis of Ice.—By Prof. CHARLES L. KENNICOTT.—A contribution to sanitary chemistry.—The possibility of danger from impure ice.—2 illustrations..... 17285

II. EDUCATION.—The Schools of Ancient Greece.—A most graphic account of school life of ancient days, with contemporary illustrations.—2 illustrations..... 17283

III. ELECTRICITY.—Lightning Arresters.—By W. R. GARTON.—The protection of electrical installations from lightning strokes.. 17280

IV. ENTOMOLOGY.—The Army Worm.—An important New York Agricultural Station Bulletin, treating of the destructive plague and how to combat it.—2 illustrations..... 17282

V. HOROLOGY.—Clocks Provided with Automatons.—An interesting subject.—Famous clocks of the world described and illustrated.—9 illustrations..... 17271

VI. HORTICULTURE.—A New Gooseberry.—The "Langley Beauty," of extraordinary size and perfection.—1 illustration..... 17283

VII. HYDRAULIC ENGINEERING.—Pumping Hot Water.—Paper on an interesting point of hydraulic engineering practice.—How the lift of a pump is affected by the heating of water..... 17272

VIII. MEDICAL AND HYGIENE.—Note on Treatment of "Black Eye"..... 17276

IX. METALLURGY.—Chains and Chain Iron.—The subject of weldless chains and chains of special construction.—Continuation of this valuable paper.—5 illustrations..... 17273
The Art of Bronze Casting in Europe.—By GEORGE SIMONDS.—Continuation of this Society of Arts lecture.—The story of a famous statue.—6 illustrations..... 17278

X. MISCELLANEOUS.—Odometers.—A road measuring machine of early times; predecessor of the bicyclist's cyclometer.—An odometer for ships.—2 illustrations..... 17274
Engineering Notes..... 17277
Electrical Notes..... 17277
Miscellaneous Notes..... 17277
Selected Formulæ..... 17276

XI. NAVAL ENGINEERING.—Experiments with Ship Models.—Recent tests of models for ships executed in England at the Barrow-in-Furness yards.—1 illustration..... 17275

XII. PHOTOGRAPHY.—Fixing and Washing of Paper Prints.—By A. HADDON.—A valuable and practical article on photographic printing..... 17275

XIII. PHYSICS.—Support for Arresting Vibrations.—The freeing of delicate laboratory instruments from vibrations due to external disturbance.—1 illustration..... 17280

XIV. TECHNOLOGY.—Black and Smoked Glass.—Formulæ for making the "mix" for the production of different glasses..... 17276

THE BICYCLE IN ITS RELATION TO GOOD ROADS.

The successful transmission by bicycle relays of a war message and a post office dispatch across the continent, the details of which are given in another column, will always remain as a notable event in the annals of transportation. While the thirteen days consumed on the journey are full of dramatic interest, the performance itself was something more than merely spectacular; it has, as it was intended to have, a serious and practical value.

In the first place, the average speed of the relay, without taking into consideration the question of the roads and the weather, was highly creditable. It figures out as eleven miles an hour for the whole distance; and this speed was maintained night and day for nearly a fortnight, across three thousand four hundred miles of country, and involved the co-operation of over two hundred riders, with just as many transfers of the package, many of which were made remote from any habitation and in the dead of night. The speed would have been creditable even if maintained for a similar distance upon a continuous stretch of turnpike roads, and in favorable weather.

To appreciate the performance at its proper value it must be remembered that not more than one-fifth of the journey was made over roads that could be termed first class; that much of it took place over unballasted country dirt roads; and that for many hundreds of miles the riders had to wheel along the old emigrant trails which, fifty years ago, carried the ox team of the pioneers into the far West. Moreover, some hundreds of miles of the steepest hill climbing were encountered in the Sierra Nevada and Rocky Mountains, where the passes lie some seven thousand and eight thousand feet above the sea, and the surface of the mountain grade is roughened and rendered perilous by "washouts," loose rock, and gravel. To the difficulties arising from poor roads must be added those due to the weather, which on several days and nights was marked by rain storms, which turned the poor roads into mud, and rendered fast travel on the good roads impossible.

Taken altogether, this performance has lifted the bicycle once and forever out of the arena of mere pastime, and has established its economic value as a reliable means of transportation under the roughest conditions. It has proved its ability to carry an emergency dispatch over good roads for hundreds of miles at a speed rivaling that of any but the fast railroad trains, and it has shown that it can perform the same service over precipitous mountain trails, day and night together, at a speed which no relay of horses dare attempt.

In its bearing upon the science of war the transcontinental relay comes in as a strong vindication of the efforts of such soldiers as General Nelson A. Miles, who hold that the bicycle is destined to play an important part in military operations. It is now clearly proved that a system of military bicycle relays may be strung out, if need be, for thousands of miles, and that dispatches can be delivered from the Pacific to the Atlantic in but twice the time occupied by the regular mails; since it is certain that with such military roads to traverse as are to be found in France and Germany, the time of crossing the continent could readily be reduced to ten days.

While it is admitted that the chief lines of military communication in time of war will be the railroads and the telegraph, there will be many occasions when these will not be available; as, for instance, where they have been destroyed by the enemy in its retreat, or by a dash of cavalry upon the lines of communication. In such cases a trained bicycle corps could very rapidly establish a system of relays which, over good roads, could transfer dispatches at a speed of twenty miles an hour. Moreover, it frequently happens that two divisions of an army may be so placed that there is no direct railroad communication between them; whereas cross country roads can usually be found which would be available—as the recent transcontinental race has clearly shown—for the speedy establishment of a bicycle relay.

It should further be noted, in judging the value of the performance in question, that the relay was composed mainly of amateur riders, to whom the exertion of riding their relay, in such weather as they encountered, was a novel experience. In the case of a military relay of this kind the riders would all be professional men, trained for the work, to whom a ten mile ride at full pressure over rough roads and in driving rain would be nothing new; and from such a trained corps it would be reasonable to look for even better records than were accomplished in the recent memorable ride.

Perhaps the most important effect of this transcontinental relay is that it has shown in a most dramatic manner the necessity for better roads. The message was carried for hundreds of miles over what are known as dirt roads, which are periodically plowed and thrown up by farmers through whose lands they run. In dry weather they are deep in dust, which in wet weather is turned into slush and mud. Careful estimates have shown that the cost of a few years of this "tinkering" would suffice, if properly applied, to turn these highways into first class macadamized roads, whose maintenance would entail but a tithe of the cost and labor which is being fruitlessly expended in the present methods.

THE AMERICAN CAR ON ENGLISH ROADS.

The intense rivalry between the East Coast and West Coast routes from London to the north of Scotland has led the officers of the companies which cover the former route to make a special bid for the summer travel this year. This did not come, as was expected, in the shape of an increase of speed, the running time of the rival roads being about the same this year as last; and though there are many features which indicate that the famous annual race will take place before the season is over, there is no evidence of it at the present writing.

The special attraction of the East Coast route consists of a complete train of eight long and heavy cars built upon the lines of the typical American car, and furnished with all the various details of equipment which characterize an express passenger train in this country.

How wide a departure has been made from the common English practice may be judged from the following particulars: The train is made up of eight cars of an average length of 67 feet, their weight being not far from 40 tons. This is more than double the length and weight of the standard English six wheeled coach. The cars are carried on six wheeled trucks. The Railway World (English) in describing the train says: "The train forms a compact whole, as the separate carriages are joined by the patent Gould combined vestibule, automatic coupler, buffer, and continuous platform, the side buffers and screwup couplings being abandoned in favor of appliances which have long been used in America. In fact, the train indicates throughout the triumph of American ideas." The cars are fitted with the raised clerestory roof, patent torpedo ventilators, double gas lights, Gould's steam heating apparatus, together with electric calls from each compartment. The English preference for privacy is shown in the retention of the compartment division of most of the cars, there being only one third class open car, with doors at each end and a passage down the center. The rest of the cars are called "composite corridor carriages," and each contains three first class and four third class compartments, a baggage room, and lavatories for each class. There is also a large baggage car with six wheeled trucks. The total length of the train is 530 feet, and it will carry about 300 passengers.

The weight of this train per passenger, however, is far greater than that of a train of the standard English cars, as was to be expected, and just here we find an explanation of the remarkable increase in size and power which is noticeable in this year's locomotives built for the Great Northern and Northeastern Companies. The former have turned out some grand locomotives on the general lines of Mr. Sterling's famous 8 foot driver singles, which have 19 by 28 inch cylinders and 8 foot 2 inch single drivers. Mr. Worsdell has also built some big machines with 20 by 26 inch cylinders and 7 foot 7 inch four coupled drivers, a full description of which will be found in our issue of August 22.

International Catalogue of Scientific Literature.

The international conference under the auspices of the Royal Society has been in every way a success from a scientific point of view, according to the London Electrical Engineer. The new catalogue is to begin with 1900, is to be in English, and is to relate to "pure" science only, applied science being excluded; but the limits are to be decided hereafter. In indexing according to subject matter regard is to be had, not only to the title of a paper or book, but also to the nature of the contents. Moreover, the catalogue is to comprise all published original contributions to the branches of science indexed, whether appearing in periodicals or in the publications of societies or as independent pamphlets, memoirs or books. The final editing and publication of such a catalogue is to be intrusted to a central international bureau acting under the direction of an international council, which will be responsible for the administration of the enterprise. Any country, however, which shall declare its willingness to undertake the task is to be intrusted with the duty of collecting, provisionally classifying and transmitting to the central office, in accordance with rules laid down by the international council, all the entries belonging to its scientific literature. The central bureau is to be in London.

Inland Shipping in Germany.

Improvements on the Oder have caused the amount of shipping at Breslau to increase from 125,000 tons in 1880 to 1,550,000 tons in 1894. The chief ports for inland shipping are Berlin, over 5,000,000 tons in 1894; Hamburg, 4,160,000 tons; Duisburg on the Rhine, about 4,000,000 tons; Mannheim, 3,662,000 tons; Magdeburg, 1,650,000 tons. All others have less than 1,000,000 tons.—Uhland's Wochenschrift.

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NOTES ON THE AMERICAN ASSOCIATION MEETING, BUFFALO, N. Y.

BY HORACE C. HOVEY.

Three papers were read by Dr. G. K. Gilbert, of the United States Geological Survey, concerning Niagara, to prepare excursionists for what they were to see after the association should adjourn. The Algonquin River was the topic first discussed, as being the outlet of what is styled Lake Algonquin, and that included the upper three great lakes. Its head was where Kirtland, Ont., now is, and it followed the Trent River to Lake Ontario. The channel marking its course is from 1,000 feet to one mile in width, and from 15 to 50 feet deep. Its volume exceeded that of the Niagara. It proves that the St. Lawrence Valley was opened before the Ottawa for theescape of the glacial Lake Iroquois; that the early history of the Niagara included an epoch when it carried only the drainage of the Erie basin; and that the Algonquin River epoch is correlated with a portion of the Niagara gorge heading at the head of Wintergreen Flat.

His second paper dealt with the Whirlpool—St. David's Channel, from the Whirlpool northward to the escarpment fronting Lake Ontario. He showed that the most recent investigations tend to confirm the opinion advanced fifty years ago by Prof. James Hall and Sir Charles Lyell that this was the ancient preglacial channel of the Niagara. The stream had far less volume and power than at present, for it only drained the Erie watershed, and probably did not exceed what is now the American Fall. Evidence from wells in the region, from rock outcrops, and from the current of the modern river proves this.

In his third paper Dr. Gilbert gave the results of an attempt by himself and Mr. F. B. Taylor to determine the profile of the bed of the Niagara River in its gorge. Actual soundings have only been made at Lewiston and in the slack water a short distance below the Falls. These meager data were supplemented by measurements of velocity and volume, and the remaining stretches approximated by studies of the water surfaces. These computations were carried out at four places with the following results: Whirlpool Rapids, only 35 feet deep; outlet of Whirlpool, 50 feet deep; opposite Foster Flats, 35 feet deep; below that point, 70 feet deep. The configuration of the channel indicates two epochs of extreme low water in the Niagara River. It was the plan of a party of the geologists to investigate these statements personally under Dr. Gilbert's leadership. The results will be awaited with interest.

Mr. F. B. Taylor read two papers supplementary to those on Niagara in which he dealt with glacial phenomena in Michigan. Three beaches of glacial Lake Warren, known as the Leipsic, the Ridgeway and the Arkona beaches, are found to correspond with three old river channels extending westward across the "thumb" of lower Michigan to the Saginaw valley. The forest beach is the only one that passes around the so-called "thumb." The Du Plain beach is about 25 feet above the Forest beach, and appears to be the joint correlation of the Ridgeway and Arkona beaches. A series of fifteen terminal moraines extends from Cincinnati to the Straits of Mackinac, and about the same number extends northeastward from Cincinnati to western New York.

Nearly an entire day was given up to the commemoration of the sixtieth anniversary of the beginning of Prof. James Hall's connection with the geological and paleontological survey of the State of New York. The veteran scientist was present in person, having come from the Pacific coast for the express purpose of showing his appreciation of the honor thus extended to him. The section gave another afternoon to visiting Eighteen Mile Creek, a famous locality for Hamilton group fossils. Mr. Grabau had prepared the members of the section for the trip by a full résumé of the work he has been doing in that vicinity.

ANTHROPOLOGICAL SECTION.—Different days were set for considering the subdivisions of Archæology, Ethnology, Psychology and General Anthropology. The meetings were admirably presided over by Miss Alice Fletcher. One of the first things done was to open a mysterious casket said to have been found under a stump three feet in diameter, sent on by Mr. Hiram J. Rich, of Wyman, Mich. The casket on being sawed open was found to contain two compartments, one with two clay balls, the other with wooden dies by which the so-called hieroglyphics were made that adorned the exterior. The find was ingenious enough to elicit remarks from Prof. F. W. Putnam, Dr. Brinton, Prof. Wright and others, the conclusion being that the casket was a fraud, and yet that the singular mounds where it was said to be found might well be worth exploration by an expert.

Next in order came resolutions in honor of the late Captain John Gregory Bourke, of the United States Army, who knew no other profession than that of arms, yet had made valuable contributions to science and literature. He was a graduate of West Point, served seventeen years on the frontier, where he developed such zeal in ethnographic studies as to warrant his being detailed for five years for special work in that direction at Washington City. In 1893 he had charge of the rare collection in the mimic convent of La Rabida, at the World's Columbian Exposition. Under all circumstances he was courageous and faithful. It was his intention to devote himself wholly to literature and scientific pursuits. He had amassed copious notes amid his Western travels, and had made wide research amid original documents. His writings show vigor and ability. He turned public attention to the secret ceremonies of the Puebloes, and stimulated many others to pursue ethnographic studies. He was last year the vice president of this section, and also president of the American Folk-lore Society. With his untimely death we lose much valuable unpublished knowledge possessed by no other person.

Among papers of interest in this section may be mentioned one on the ancient pottery found in the Mississippi Valley by Prof. C. C. Willoughby, of Cambridge, Mass. He showed by illustration and description the development from simple circles, disks and crosses of the more complicated symbolic forms, and finally of those intricate and elegant designs found purely for decorative purposes on the antique pottery of Missouri and Arkansas.

The symbolic rocks of Newbury and Byfield, Mass., were described by Dr. H. C. Hovey. They were unlike the slate and sandstone monuments, of which thousands are to be found, being all of them of diorite, evidently from one workshop, probably located at Byfield. Besides tombstones, a set of milestones two hundred years old had recently been unearthed from amid the grass and weeds between Boston and Newbury. The ornamentation on them was pagan instead of Christian, and much of it was apparently phallic, and the wonder was that the staid old Puritans should have employed such an artist.

Prof. G. F. Wright narrated the results of experimental excavations carried on at the Lalor farm in Trenton, N. J., by Mr. Earnest Volk, under the direction of Prof. F. W. Putnam, for the American Museum of Natural History in New York. The subject has hitherto kindled controversy, but the disposition now seemed to be to accept the valuable evidence thus brought to light as to the relative age of the Trenton gravel and its paleolithic implements.

The road to the ruins of Tzac Pokama, in Guatemala, runs through an immense pine forest, and they include the foundations of what was once a populous city, with temples, palaces and other structures. These were described by Mr. J. R. Chandler. He said that every temple stood in a plaza, around which had been ranged the dwellings of the priests. Every strategic point on the mountain was once fortified by a castle, fort or pyramid. The central palace was 190 feet long, with walls 8 feet thick. On the highest point stood a fortress 240 feet long, with a pyramid 40 feet high, the whole built on terraces whence the Tzac Pokama can be seen in its entirety, as well as the hills, volcanoes, valleys and rivers for hundreds of miles around. This splendid city could have held three times as many persons as now inhabit Guatemala. Few utensils were found and no statues, sculptures or hieroglyphics. There is also a conical hill called Mumuz, with a sacrificial pyramid, through which goes a winding passage, said by tradition to lead to a rich subterranean city.

Prof. E. W. Claypole described some curious human relics from the drift of Ohio. One of them was a grooved ax of green slate, found in digging a well, and at a depth of 22 feet, in undisturbed ground, resting on bowlder clay. It was deeply weathered. Another relic was a flat oval slab of slate found at the depth of 6 feet. He concluded that man was present when the glacial deposit was formed and that, in Ohio at least, glacial man was not a fiction. The only wise way seems to be to accept such facts as are verified and yet to take ample time for the formation of explanatory theories.

A paper by Prof. W. J. McGee described the stone implements of the Seri Indians, of Tiburon Island, in the Gulf of California, which are extremely simple and primitive. Their metate is simply a naturally shaped stone suitable for grinding uses, usually a waveworn pebble picked up on the beach. And so with their other tools and utensils. They represent random selection and a final form determined not by design but by selection. Such stones cannot be said to be either paleolithic or neolithic, but might be styled protolithic, and considered as anterior to the commonly recognized types of stone art, so far as accultural development is concerned.

A paper was read by Hon. Horatio Hale, of Canada, showing that the aboriginal tribes of eastern North America, especially the Iroquois and Algonquins, made use of a monetary currency, and recorded facts and events by means of a certain script. Perforated shells were in use from very early times as valued treasures and finally as money. Thus, in China, the most ancient currency was shell money strung on a string. This was superseded B. C. 2000 by copper coins known as cash. In the Micronesian Islands the shell money has been in use during the present century. It still exists along the Californian and Oregon coast. Thence it probably crossed to the Atlantic side of the continent. The use of the wampum belt is a comparatively late invention, ascribed to Hiawatha, who founded the Iroquois confederacy in the fifteenth century. His name means the "wampum belt maker." Machine-made wampum came in with the whites a century after their arrival here.

Prof. F. W. Putnam, the curator of the Peabody Museum, and for many years the permanent secretary of the A. A. A. S., gave an exceedingly interesting report of the recent explorations carried on by Harvard University in Honduras, Guatemala and Yucatan. He dwelt particularly on the discoveries made at Coapan, where they have been working for three years, with a concession from the local government, giving them an exclusive right for seven years to come to conduct archæological explorations.

On the whole the forty-fifth meeting of the A. A. A. S. in the delightful and hospitable city of Buffalo was so successful that by general consent it was agreed to return there after another decade, as had already been done for four decades past.

Death of Prof. Palmieri.

The news of the death of Prof. Luigi Palmieri, "the master of Vesuvius," will be read with profound regret by all scientists. He will be missed, not only from a scientific point of view, but from a practical one also. For forty years he lived on the volcano and knew its every mood, so that he predicted every eruption of the volcano and saved thousands of lives. Nearly every year the great meteorologist invented some new instrument which would aid him in his studies. His splendid observatory is situated at an altitude of 1,970 feet above the sea level, on a projecting ledge of rock which runs out from the foot of the crater of Vesuvius. This interesting observatory was described in the SCIENTIFIC AMERICAN SUPPLEMENT for October 24, 1885, No. 512.

Prof. Palmieri was born at Faicchio, Italy, on April 22, 1807. He studied at Cajarro and Naples and afterward started a successful scientific school. He held important positions in many institutions of learning and in 1854 was made director of the Meteorological Observatory on Vesuvius. He rapidly became celebrated by his researches and writings, and in times of eruption he heroically stuck to his post, so that in 1872 he nearly lost his life. His graphic account of this eruption is one of the classics of science. The people in the villages at the foot of the mountain fled, but he made his minute observations high on the mountain while his thermometer registered 130 degrees and the air was so surcharged with sulphur that it could hardly be breathed.

Death of Dr. Goode.

Dr. George Brown Goode, assistant secretary of the Smithsonian Institution and in charge of the National Museum, died at his home near Washington on September 6. He was born in New Albany, Indiana, in 1851. He graduated at Wesleyan University in 1870 and began his museum work in the next year at that university. In 1873 he became a member of the staff of the Smithsonian Institution. He was sent to the Centennial Exhibitions in Philadelphia in 1876 as director of the Natural History Division. He was appointed United States Commissioner to the International Fishery Exhibitions held in Berlin in 1880 and in London in 1883. He was also connected with the following expositions in an official capacity: The New Orleans, Cincinnati and Louisville Expositions in 1884; the Columbian Expositions, 1893; the Atlanta Exposition of 1895. He has been in charge of many of the divisions of the Smithsonian Institution where great scientific knowledge was required. He was recognized as an authority on museums and their administration. He published more than one hundred papers on ichthyology, museums and fishery economy. His death leaves a gap in the scientific circle of Washington.

Li Hung Chang at Niagara.

When his Excellency, Li Hung Chang, visited Niagara Falls on September 6 he expressed a desire to visit the power house of the Niagara Falls Power Company. His wish was gratified and he was carried into the power house in his chair. He asked many questions, pointing here and there with his ebony cane, which had been given to him by Mrs. U. S. Grant. The earl put out his cane to indicate a wheel in some part of the electric apparatus. A blue flame shot out, linking the earl to the generator through the medium of the iron shoe on the cane. An instant later the stick was jerked from his hand and it went flying over his shoulder. Fortunately his Excellency was unhurt except for a wrench his wrist had received. He went right on with his questions as if nothing had happened.

Measuring the Interior of Buildings.

A simple method of measuring heights in the interior of churches and other buildings consists in attaching a graduated string or tape to a small balloon such as is easily obtainable anywhere. This method might also be readily applied for measuring the height of caverns.—Prometheus.

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THE COLUMBIA RIVER SALMON FISHERIES.

(Continued from first page.)

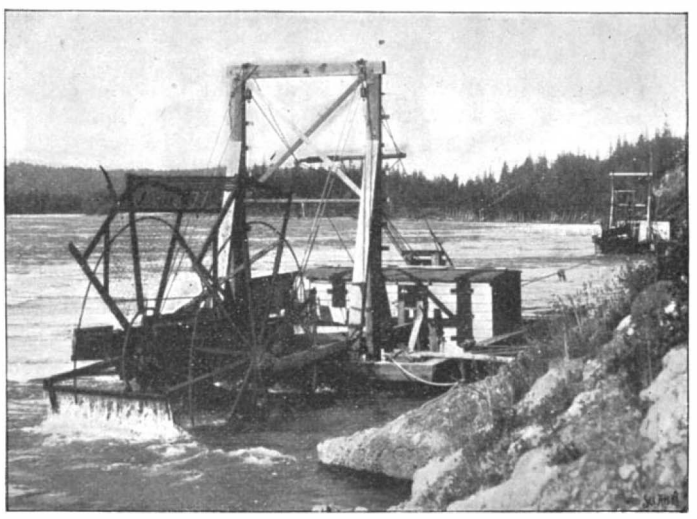
wheat crop of Oregon and a part of Washington to Liverpool, and it has also a considerable trade in lumber. Its chief importance, however, is derived from the extensive and world-renowned salmon fisheries of which it forms the headquarters. The fishing grounds extend through the whole length of the lower Columbia, whose shores are studded with the wharves and white buildings of the canneries or packing houses, the largest of which are located along the water front at Astoria, where there are sixteen in all.

The most famous variety of fish taken in the Columbia River is that known as the Royal Chinook salmon. Its excellence is due to the firmness of the flesh, its delicate flavor, and its large proportion of oil. It varies greatly in size and weight, ranging from 20 to 80 pounds, the latter being an exceptionally large fish. In addition to the Chinook, three other varieties are common: the Blue-back, the Steelhead and the Silver-side. But, though they command a good price, they do not equal the Royal Chinook, which is the distinctive fish of the Columbia River, and the one upon which the reputation of the canned salmon has been built up.

The salmon is a deep sea fish which spawns in fresh water. The spawning grounds are located far inland, at the head waters of the rivers, and it is while they are entering or making their way up the river that the fish are caught. On the Columbia River the "running" commences in April and continues until October. As the salmon passes up the river it deteriorates in quality, as the result of its abstinence from food and the exertion of running the rapids. At the spawning time the fish becomes quite unfit for food, and after the eggs are laid it dies on the spawning ground. The eggs are deposited in the sand or gravel at the head waters of the river in which the parent fish were hatched, the young salmon invariably returning to what might be called their home waters. In spawning, the salmon makes a hole with its tail in the sand, where pure running water is to be found, and, after depositing the eggs, covers them up. The young fish do not make their way out of the sand until they are perfectly formed. They remain in fresh water until they are about as large as a smelt, when they are able to protect themselves against natural enemies; and then they go to the ocean, returning in four years' time to spawn. Authorities claim that the great difference in the size of the fully developed fish is due to the difference in the food they may happen to secure. The young salmon, when they encounter a school of smelt, will follow the latter continually, seizing the smelt at will when hungry. It is estimated that not more than five per cent of the fish which are hatched at the spawning grounds return to the ocean full grown. The loss is due mainly to the voracity of the various varieties of fish, including the young salmon that have not yet returned to the ocean. The latter live almost entirely upon their kind, the newly hatched fish being an easy prey to the older salmons' attack.

It is now believed that artificial hatching, and a further limitation of the open fishing season, are the only means of perpetuating the fishing industry; and two hatcheries have been established in the States of Washington and Oregon. In artificial hatching the loss is relatively small, not over ten per cent, as the young fish can be preserved until it is large enough to protect itself from the enemy by flight.

On the lower Columbia the fish are taken by means of fixed nets known as fish traps, by movable or seine nets, and by floating or gill nets. The fish trap consists of a row of piles which is driven in line from the shore or shoals out to the deep water in which the fish are accustomed to run. Here the piles are driven in a circle forming a pound, and the whole trap is covered with netting. The fish strike the netting and follow the trap until they reach the pound, where they are readily taken. The seine net is about 1,500 feet long, contains 650 pounds of twine, 200 pounds of rope and 150 pounds of lead, and costs fully $1,000. It is handled from the shore, being paid out from the boat on which it is loaded, in a wide semicircle, and horses are used to haul it in. Seining is most profitable in those years when the river is low. Most of the season's catch, however, is taken with the gill net, which varies in length and depth according to the means of the owner. They are frequently 1,800 feet long and from 20 to 25 feet deep, the material alone costing from $275 to $300. The size of the mesh varies from 7 to 10 inches, the latter size being used from June to August, when the fish are uniformly large. Lead sinkers are attached to the bottom, and cork or cedar floats to the top line of the net. Gill net fishing is carried out in specially constructed boats which have been built to meet the requirements of these fishing grounds. The boats are usually owned by the canneries and loaned to the fishermen, who are paid so much a pound (about 5 cents) for their catch. The fishing is done almost entirely at night. The net is "cast" across the stream, with a wooden buoy at one end and the fishing boat at the other. It is held in a perpendicular position by the lead sinkers, and slowly floats down the stream. The fish are caught by the gills in attempting to pass through, and are drawn up and thrown into the boat, which is rowed up and down the line for this purpose.



A FISH WHEEL IN OPERATION.

On the upper Columbia a truly remarkable contrivance known as the fish wheel is used. To the rear end of a scow a large wheel is attached in such a manner that it can revolve under the impulse of the running water. Upon it are fixed several large net-covered scoops or pockets, whose mouths open down stream, or in the opposite direction to the run of the salmon. The scow is moored in the path followed by the fish, which, as they run into the scoops, are lifted up and automatically dumped into the scow.

The bulk of the salmon catch is cleaned, cut up, boiled, and canned by extensive establishments called canneries, one of the largest and most celebrated of which is shown in the accompanying illustration. The canning is done by Chinese labor, and the fishing is largely carried on by fine, stalwart men from the stormy coasts of Scandinavia and Northern Russia.

This profitable industry was established in 1866, some thirty years ago. The first year's product consisted of 4,000 cases, with a total value of $64,000. In ten years time the annual output had increased to 450,000 cases, valued at $2,475,000; and last year's pack amounted to 600,000 cases, valued at $3,000,000; the gross weight of the salmon utilized being nearly 20,000 tons. The total weight of salmon utilized in canning during these thirty years was 365,000 tons; and this was shipped in 11,000,000 cases, and represented a money value of $64,500,000—a truly remarkable record.

FISHING WITH THE GILL NET.

We are indebted to the courtesy of Mr. M. J. Kinney and Mr. Robert Gibson, of Astoria, Oregon, for photographs and particulars.

IN the various alphabets of the world the number of letters varies from 12 to 202. The shortest alphabet is that of the Sandwich Islanders, which has 12 letters, the Tartarian, the longest, containing 202 letters.

Balloon Experiences in War Time.

Die Vedette, a paper published in Vienna, and devoted to military literature, gives an account of the use of balloons by the French army during the investment of Paris by the Germans in 1870, together with a most interesting sketch of the experience of two of the aeronauts, says the Army and Navy Journal. During that period there were 65 balloons used, which carried out of Paris 150 persons and over 4,000,000 letters. Five of these balloons were captured by the Germans, two were lost and never heard of, and one, after a journey of fourteen hours, landed on top of Mount Lifjeld, in Norway. The occupants of this balloon were Paul Rolier, an engineer of the army, and L. Dechamps, an officer of Franc-Tireurs. They ascended from Paris on the night of November 24, 1870, with dispatches from Gen. Varchu for the commander of the Army of the Loire; in addition they carried 500 pounds of mail, six sacks of ballast, and six carrier pigeons. The wind blew from the southeast, and all was well until six o'clock the next morning, when the balloonists found themselves out of sight of land, with nothing but the ocean under them. Dechamps collapsed, while Rolier remained cool under the critical situation in which they found themselves. About eleven in the forenoon a ship was sighted, and in the hope of being discovered and rescued by it, the balloon was lowered to within a few yards of the surface of the water. The ship suddenly altered its course, and the aeronauts were compelled to ascend again, which they accomplished by throwing out all of their ballast and one sack of mail. Finding themselves in an altitude of over 2,200 yards, and in an atmosphere of almost unbearable frigidity, they lost all hope and determined to end their sufferings by setting fire to the balloon. Fortunately the matches in their possession would not ignite, on account of the frost which covered their clothing and everything else in their surroundings. About 2:30 in the afternoon a mountain top became visible. When near it the aeronauts succeeded in lowering the balloon; the boat caught in the top of a tree. Rolier promptly disembarked, but Dechamps became fastened in the rope attached to the anchor; in a moment he was suspended in the air by his feet, the balloon began instantly to rise again, but Rolier succeeded in freeing his companion from the entanglement and the balloon vanished from their sight. Although miraculously saved, yet standing in an unknown country, hungry, without proper clothing, and suffering from the intense cold, the aeronauts were still in a dangerous plight. It was their good fortune to select a westerly direction for their march, but Rolier soon broke down from exhaustion. His companion took him to an undergrowth near by, where the exhausted traveler fell asleep. Dechamps continued his journey and soon found a hut filled with hay, to which he carried his companion. They buried themselves in the hay and slept until the following morning. Continuing their journey on foot, they found traces of a sleigh, which led them to a hut of wood choppers. Although unable to converse with them, the aeronauts ascertained that they were near Christiania, to which place they were brought the following day. The news of their adventure spread with rapidity, and soon after it was ascertained that the balloon had landed near Trammen, in Norway, and was secure with its freight.

Russia's Purchases of Machinery.

The Russian government has been negotiating for some time with the Delaware Iron Company, at New Castle, Delaware, to secure a large amount of its machinery, and the bargain has been consummated finally. The contract entered into involves the delivery of all the material of the tube and pipe mill connected with the iron company's big plant. It also involves the sending to Russia of a large force of workmen, who will be engaged abroad to put the machinery together and start it in good running order. To transport the property thus purchased the British tramp steamer Henley has been chartered by Hagar & Company, Philadelphia. Besides taking out the material furnished by the iron company, the vessel will carry additional machinery bought in this country to Mariapole, on the Sea of Azov. The sale by the iron company of its tube and pipe plant does not in any way affect the future conduct of its works. As soon as the cargo is shipped the Delaware Iron Company will go ahead replacing all that it has sold to the Czar's government.

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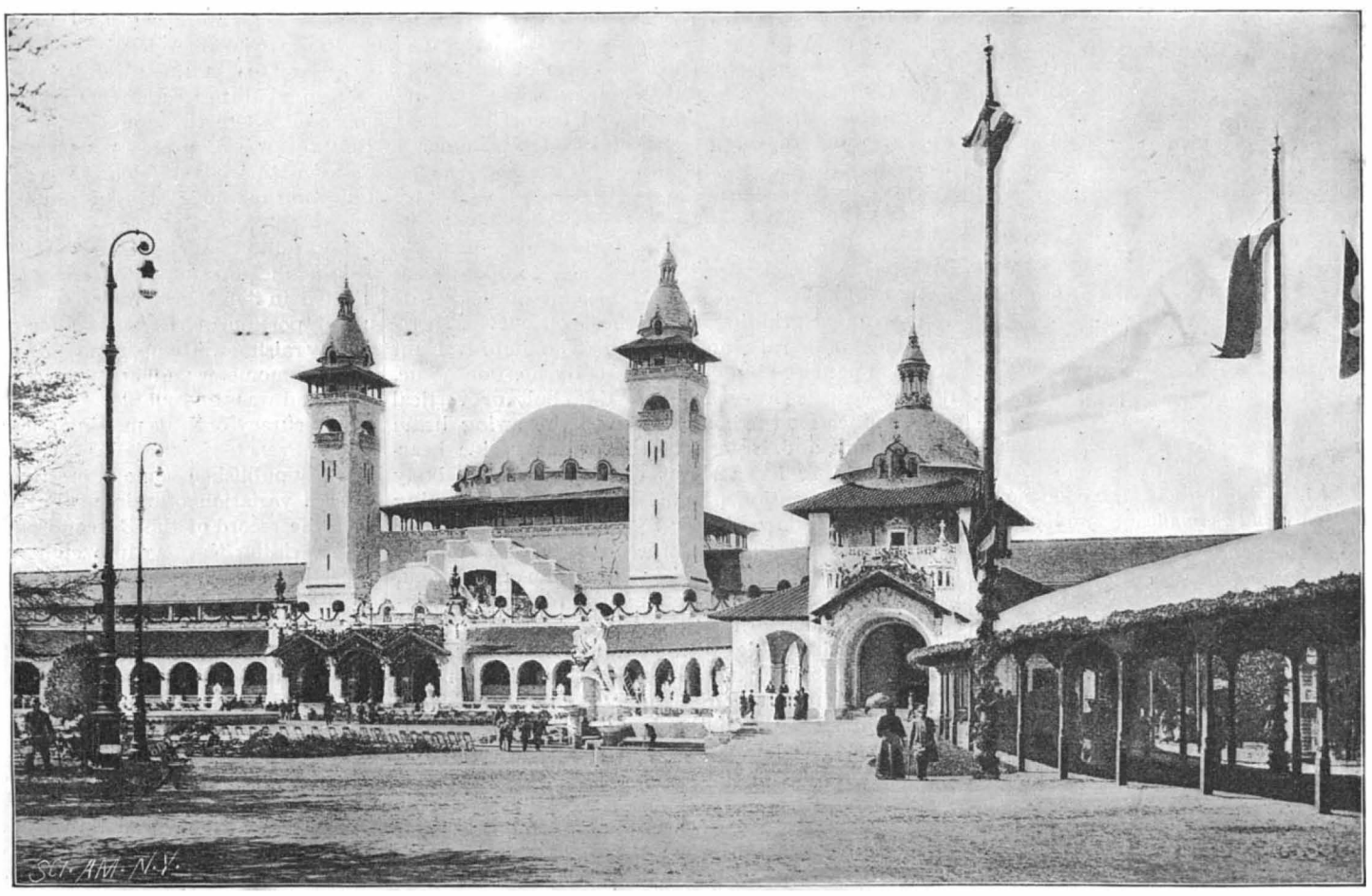
THE BERLIN INDUSTRIAL EXHIBITION.

The Berlin Industrial Exhibition was opened by Emperor William on May 1, and, though the exhibition is a meritorious one, its success has not been remarkable. The exhibition is intended to commemorate the twenty-fifth anniversary of Berlin as the national capital of the German empire. The national authorities co-operated with the municipal authorities to make an industrial exhibition which should present a complete picture of the achievements of the industries and arts of Berlin and to show their importance in relation to the national life of Germany. From what has just been said it will be seen that the exhibition is not on an international scale. As the exhibition will remain open until October 15, it is to be hoped that the exhibition will draw a larger crowd of visitors than it has done heretofore. The exhibition grounds in Treptow Park have a greater area than those of most international exhibitions, and offer great advantages by their close proximity to the city and their picturesque beauty, which has been enhanced by successful landscape gardening. In our issue for May 9, 1896, we presented a bird's eye view of the grounds and buildings, and we now give illustrations of two of the more monumental features of the fair—the industrial building and the main restaurant and water tower.

The main building covers a space of 570,280 square feet, and houses a large part of the exhibits. The dome is covered with aluminum, and, as regards the architecture, it might be said that it looks very much like some of our Florida hotels. The Berlinese are very fond of hotel and cafe life; so it is little wonder that the restaurants came in for a liberal share of attention in laying out the Exhibition.

The second illustration shows the main restaurant, which is situated at the opposite end of the lagoon from the main building. It consists of a large building, masked by the ornamental semicircular loggia and the water tower, which is treated with great felicity. On the whole, the group of buildings is admirable, and is peculiarly adapted for use to close in the end of the lagoon. For our engravings we are indebted to the Oesterreichische Monatschrift fur den öffentlichen Baudienst.



BERLIN INDUSTRIAL EXHIBITION—MAIN INDUSTRIAL BUILDING.

BERLIN INDUSTRIAL EXHIBITION—MAIN RESTAURANT AND WATER TOWER.

Curiosities of the Tooth Brush.

In the Dental Practitioner Dr. Parmele notes that in some old books published during 1600, directions are given for preparing certain roots that are used to clean the teeth, lucerne and licorice roots being specified. These roots are directed to be boiled and cut into pieces six inches long, the ends of each being split with a penknife into the form of a little brush, after which the pieces are slowly dried to prevent splitting. In use, one end is moistened with water, dipped into tooth powder, and rubbed against the teeth until they look white. Brushes similar to these are said to be used at present in some parts of Turkey, but many Turks use ordinary European tooth brushes, though as even the most lax among them look upon the pig and all belonging to it as vile and unclean, they would as soon think of eating a pork chop or a rasher of bacon as of defiling their mouths with a Russian bristle brush. "The shopkeepers, therefore, swear by their heads and the souls of their fathers and mothers that the hair of which their brushes are made grew on the back of the camel, the cow, or the horse."

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The Providence Motocycle Race.

The most unique feature of the seventy-sixth annual Providence State Fair was undoubtedly the series of horseless carriage races. This is the third contest of motocycles held in America, the first one taking place in Chicago, in a storm of snow and sleet. The Cosmopolitan race on Decoration Day, from New York to Irvington, can hardly be considered of much value, as only two makes of motocyles went over the course. Both of these were road races; as a matter of fact, neither of the races was productive of fast or even moderate time. The State Fair management realized the importance of giving inventors an opportunity to show what speed results can be obtained.

Until within a week or so of the date of the first race the entries came in so slowly that it was feared the contest would have to be abandoned, but almost at the last moment six or seven entries were made, which brought the total number up to twelve. Seven machines started in the race on September 7. The race itself consisted of five laps, five miles each, one lap to be raced each afternoon of the fair week.

One of the conditions of the contest was that the carriages should not run at a slower speed than fifteen miles an hour, which the managers deemed a conservative figure, in view of the many statements of the manufacturers that their motocycles were capable of making from 25 to 40 miles an hour. Of the seven starters, four of them ran within the limit of the conditions, that is, they made the five miles inside of twenty minutes. The winner of the first lap was an electric motor carriage, manufactured by the Riker Electric Motor Company, of Brooklyn. This carriage covered the distance in 15·01¾, single miles averaging a fraction over three minutes. The crowd which witnessed the race was very enthusiastic, and it was a strange sight to see the so-called "vehicle of the future" taking the place of horses on the race track. The electric carriages made a particularly fine showing. The Duryea carriages have already been described in the columns of the SCIENTIFIC AMERICAN.

Prof. Pickering, of Harvard, officiated as chairman of the judges. He was assisted by Prof. Alonzo Williams, D. M. Thompson, president of the Corliss Steam Engine Company, and ex-Governor D. Russell Brown.

The result of the first lap of five miles and the time made by the several machines follows:

First—Riker Electric Motor Company; driver, A. H. Whiting. Time, 15:01¾.

Second—Electric Carriage and Wagon Company; driver, H. G. Morris. Time, 15:13½.

Third—Duryea Motor Company; driver, William McCall. Time, 18:47½.

Fourth—Duryea, owned by G. W. Hewitt, of Springfield; driver, J. J. Rynne. Time, 19:31½.

Fifth—Duryea, owned by Fiske Warren, Boston; driver, E. B. Mekins. Time, 20:03½.

Sixth—Duryea, owned by J. Frank Duryea; driver, Mr. Duryea. Time, 20:59.

Seventh—Duryea, owned by J. Frank Duryea; driver, Warren Root. Time, 21:23½.

The fastest heat was made by Riker's machine; time, 2:47½.

The horseless carriage race of September 8 was more closely contested than that of the preceding day, when Riker and the Electric Motor Company had it all to themselves.

The time was as follows:

Riker Electric Motor Company, New York, 13:6; Duryea Motor Wagon Company, Springfield, Mass., 13:14; Electric Motor Wagon and Carriage Company, Philadelphia, 13:33; George Henry Hewitt, Springfield, Mass., 16:12; William M. Ashley & Son, Springfield, Mass., 16:31; J. Frank Duryea, Springfield, Mass., 17:52; George H. Morrill, Boston, Mass., 18:19; Fiske, Warren & Co., Boston, ran only four miles.

Recent Archæological News.

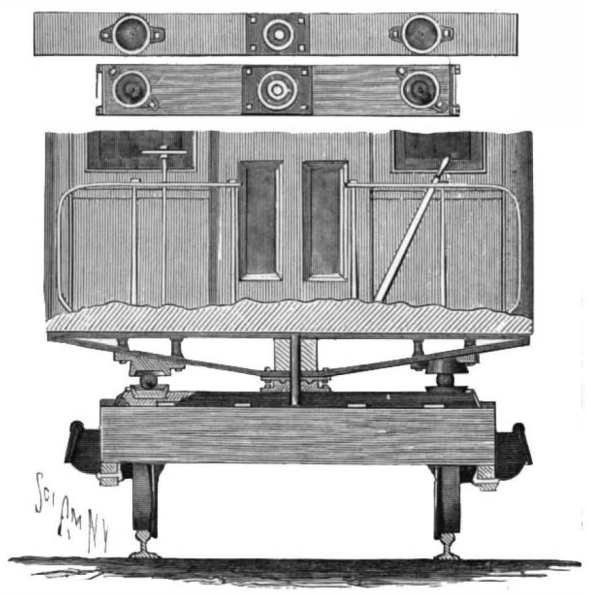
At Austerfield, near Bowtry, in Yorkshire, one of the two villages from which the Pilgrim fathers come, a row of Norman arches have been discovered in perfect preservation, but built upon the wall of the village church. The church is small, the chancel being but twelve feet wide and the rest of the church eighteen feet. It has a splendid Norman doorway and an ancient font.

Mr. Sayce tells, in the Academy, of the discovery by him of an inscription coeval with Cheops, the builder of the Pyramid of Gizeh. The locality was the island of Elephantine. The inscription was made on a bowlder, and records a visit of "Assuan to Khufu-ankh." In the Cairo Museum there is a granite sarcophagus of this king. There is nothing bearing on the pyramid. What is of moment in this discovery is this, that a monument of the Fourth Dynasty should be found so far south. The date of the inscription must be so ancient that it was made before the wall was built around the city of Elephantine. While working on the island of Philae, Capt. Lyons has found many Roman remains, some as late as the Byzantine period.

Is it known generally that works of art were well paid for in ancient times? A German review furnished recently some particulars about that question. Polygonotus, of Thasos, who lived about 450 B. C., refused, it is true, any payment for his works, and declared that he was sufficiently rewarded with the title of "citizen of Athens," which had been conferred on him. But such disinterestedness was seldom imitated. Thirty years later the painter Zeuxis, of Heracleum, was called to the court of Archelaus I, King of Macedonia. He received for his frescoes in the Palace of Pella 400 "minas," about $8,000. Mnasoo, of Elatha, paid $20,000 for a "Battle with the Persians," which he had ordered from Aristides, the leader of the Theban school. Pamphilius, of Sycione, gave a course of lectures on painting; each pupil paid for attendance one "talent," or $1,200 a year. Appelles received twenty gold "talents," about $24,000, for a portrait of Alexander I, ordered by the city of Ephesus.

A NOVEL BALL BEARING FOR CAR TRUCKS.

The illustration represents a durable, practical, and sensitive car truck bearing, designed to relieve the springs of lateral motion, and to a great degree do away with the grinding of the wheels on curves, thereby saving both rails and wheels. The improvement has been patented by William J. O'Byrne, Pontoosuc, Ill. The car has at each end a king bolt or vertical pivot connecting the body bolster to the swing beam of the truck, and, instead of the ordinary side bearings, providing for a slight oscillation of the body bolster, the invention provides the improved bearing shown in position on a car in the large view. The small figures show an underneath view of the body bolster and a plan view of the swing beam of the truck, with the lower bearings applied, the plates being recessed or cup shaped on their adjacent faces to form small oscillating tables with a circular retaining marginal flange, inside which a comparatively large metal ball is free to roll in all directions. A sensitive bearing is thus formed between the body bolster and swing



O'BYRNE'S CAR TRUCK BEARING.

beam at each end, allowing the trucks to readily adjust and readjust themselves in all directions. The ball is preferably about three and a half inches in diameter, and is not retained to any special curve, as is the case with the ordinary ball bearing, but moves progressively over the table surfaces as it rotates about its center, doing away with oil and waste, and moving sensitively without any sliding friction.

The Genesee Dam Project.

The Mount Morris storage dam project is about to take a new form. The survey undertaken by State Engineer Adams and George W. Rafter, of Rochester, N. Y., under the appropriation of the last Legislature, has resulted in the discovery of serious obstacles to that project, such as insecure foundations for the dam and the vast superiority of a dam at Portage. While the former would give a fall to Rochester of 50 or 60 feet, the latter would give a fall of 330 feet, thus affording a water power of immense value to the industries of Rochester and intermediate points. The new plan would cost much more than the Mount Morris dam, as it involves the submergence of six villages and a large amount of valuable farming land; but it is pointed out that the opposition on this account would probably be overcome to a large degree by the advocates of the construction of similar State dams on the Hudson, Black, Chemung, and Mohawk Rivers.

The Largest Merchant Steamer.

The Hamburg-American Steamship Company's new twin-screw steamer Pennsylvania was launched at the Harland & Wolff shipyard at Belfast, Ireland, September 10. The new vessel is the largest merchant steamer afloat, being of 20,000 tons carrying capacity. She is 558 feet long, 62 feet beam, and 42 feet deep. The Pennsylvania is designed to make an average speed of 14 knots an hour and will also carry a limited number of passengers, 200 first cabin, 250 second cabin, and 1,000 steerage.

Science Notes.

The poisonous nature of acetylene gas suggested to M. Chuard the possibility of employing calcium carbide as an insecticide. He proposes to try mixing carbide with earth, so that under the influence of moisture acetylene would be given off slowly at the roots of plants, thus preserving them from attack. It is proposed to try this against the phylloxera. At the present price of calcium carbide, however, it would be entirely impossible to use it as an insecticide.

In the course of legal analyses, where it became necessary to examine carefully very small quantities of stearin and other candle material upon pieces of clothing, and where the quantity of material was so small that the use of capillary tubes was impossible, Van Ledden-Hulsebosch (Pharm. Weekblad) devised the following method: He laid small pieces of the cloth on which the fat was detected in a small aluminum capsule, and floated this upon water in a large beaker. He then heated this water bath very carefully, and suspended in it a thermometer so adjusted that only the upper portion of the water affected the thermometer. Slowly raising the temperature, he kept a close watch on the thermometer and upon the grease under examination, and was thus enabled to determine with considerable accuracy both its melting and congealing points.

The French journal Les Sciences Populaires has recently published some interesting researches on the diurnal variation of rain at Paris. M. Angot shows from the record of the Bureau Central Meteorologique that dividing the day into eight parts of three hours each, the summer rain fall of the last five years has been heaviest between three P. M. and six P. M. and the lightest falls occur between nine A. M. and noon. In winter the probability of rain or snow is greatest in the morning hours, and reaches a maximum between six A. M. and nine A. M., but in summer, however, the maximum fall of rain, as regards quantity, occurs in the afternoon between the hours of three and six o'clock. It is usually stated that rainfall is most frequent and heavy in the hours between noon and midnight, but the figures of M. Angot prove that this is true only in summer.

Not infrequently the pursuit of microbe and germ theories leads people to absurd conclusions. In the Annales de Micrographie, M. Miquel gives statistics for ten years of the numbers of bacteria in a cubic meter of air, both in the center of Paris and in the park of Montsouris. In consequence of local improvements, the air in the park has gradually become purer, the number of bacteria having decreased from 480 per cubic meter in 1884 to 275 in 1893; but the air in Paris itself has increased in micro-organisms from 3,480 in 1884 to 6,040 in 1893. This large increase, Nature says, M. Miquel attributes to the greater cleanliness of the inhabitants, who, by dusting out and cleaning their houses and shaking carpets, etc., stir a large quantity of germs into the air. He even goes so far as to condemn this form of cleanliness, on the ground that the germs are simply blown about by the wind, and find their way into the houses again, so that if you do not get your own germs back, those from your neighbors fly in at the window instead.

M. Moissan has found that when acetylene is allowed to impinge upon pyrophoric iron, which has been reduced by hydrogen at the lowest possible temperature, the gas is decomposed with incandescence into its constituents. At the same time condensation takes place, and a liquid hydrocarbon, rich in benzine, is produced. The same result is obtained if pyrophoric nickel, or cobalt, is substituted for the iron. No gaseous compound of either metal is obtained, and he concludes that the decomposition is due to physical causes.

Sir John Lubbock, the naturalist, has been experimenting to find out how long the common ant would live if kept out of harm's way. On August 8, 1888, an ant which had been thus kept and tenderly cared for, died at the age of fifteen years, which is the greatest age any species of insect has yet been known to attain. Another individual of the same species of ant (Formica fusca) lived to the advanced age of thirteen years, and the queen of another kind (Lasius niger) laid fertile eggs after she had passed the age of nine years.

In connection with his geological and cosmological investigations, Prof. Clarence King has constructed a series of temperature gradients, as they are termed; that is, tables with diagrammatic representations of temperature and pressure from the surface to the center of the earth. He finds that, while there is really a very slight change of temperature from the surface to the center below a certain superficial depth, the pressure augments with one downward sweep to the center; thus it passes 1,741 degrees at 175,000 atmospheres, thence steadily augmenting until at the center it reaches over 3,000,000 atmospheres pressure; it appears, therefore, that the empire of heat over pressure is confined only to the superficial layer of the earth, that of pressure over heat being not far below the surface and increasing steadily downward to the center. The temperature of the earth, as a globe, according to Prof. King's investigations, never exceeded 2,000 degrees Cent., and the central portions are made up of very dense substances, such as metals and their compounds.

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Correspondence.

A Cheap Fluorescent Screen for X Rays.

To the Editor of the SCIENTIFIC AMERICAN:

It may interest some of your readers to know that a good fluorescent screen for X ray experiments can be made by coating a piece of pasteboard with prepared glue and sifting on a coating of common zinc white (oxide of zinc), which can be obtained very cheaply at any paint or drug store.

It is not quite equal to tungstate of calcium, but fluoresces brilliantly enough to make a really excellent screen for most experiments, and the cost is much in its favor.

The fact that none of our X ray investigators have noticed—in so far as I know—the fluorescence of this very common substance may be an incentive to still further investigation in this line and possible discovery of something still better than the tungstate of calcium.

Middletown, N. Y. H. C. OGDEN.

Recent Patent and Trade Mark Decisions.

Dunbar v. Eastern Elevating Company (U. S. C. C. N. Y.) 76 O. G. 788.

Portable Elevators.—The Dunbar patent, reissue No. 10,521, has been held novel and patentable. The court says: "The idea of moving the elevator leg to the hatch of the vessel instead of moving the hatch of the vessel to the elevator leg was certainly a brilliant and ingenious one." It would not be suggested by the patent to Sykes, No. 95,747.

Reissue of Patent to Secure Canceled Claims.—Where claims were canceled because of the belief that another patent was prior, they may be obtained by reissue if this is found to have been a mistake and the application be seasonably made.

The "Whereby" Clause in Claims.—The "whereby" clause in claims is descriptive of operation and function, and since it adds no new element to the combination, it is immaterial.

Infringement.—An infringer cannot escape by varying non-essential details. They cannot take the substance of an invention and leave the shadow.

Mullen v. King Drill Company (U. S. C. C. Ind.) 76 O. G. 790.

Grain Drills.—The Mullen patent No. 355,462, for drilling seed between corn rows, is valid.

American Soda Fountain Company v. Green (U. S. C. C. Penn.) 76 O. G. 964.

Novelty of Combination.—The fact that all the elements of a combination may be found partly in one structure and partly in another is unsafe ground for overturning a patent. Where the desired object is accomplished by the mutual relation and co-operation of the several parts embraced in a claim, it is a combination and not an aggregation.

Soda Water Apparatus.—The Witting patent, No. 414,272, has been held valid as to claim 2.

Beale v. Spate (U. S. C. C. N. Y.) 76 O. G. 965.

Stair Pad.—The Sperry patent, No. 363,695, has been construed and limited to specific description. The law is imperative that a patentee must be confined to his claims, when clear, although he may have needlessly restricted them.

Knight v. Bagnall (Sec'y of Int.) 76 O. G. 1115.

Appeal from the Commissioner of Patents to the Secretary of the Interior.—No appeal which seeks a reversal of a judicial or quasi-judicial act of the Commissioner of Patents can be made to the Secretary of the Interior.

Ex Parte Schaeffer (Com. Dec.) 76 O. G. 1118.

Application for Joint Invention.—An application for a joint invention must be made by all of the joint inventors and cannot be made by one, although he requests it to be made to all the joint inventors

Prices of Bicycles in England.

A question is continually being asked as to whether the prices of cycles will not drop; and the question is generally followed by some remarks on the cheapness of iron and steel. A visit to a high-class cycle factory would go far to explain the reason for the apparently high prices of first-class cycles. Consider first the parts which join the tubes of the frame; these can be made either of malleable castings or of steel stampings. Now a malleable casting, if perfect, is probably as good as a steel stamping, but it is not to be depended on. It may have a flaw somewhere, generally caused by an air bubble in the metal, which cannot be discovered. It may happen that this particular flawed casting does not play a very important part in the economy of the machine; if so, all may be well. But it may also happen to be one of the chief bearings of the machine, and disaster may arise through it. Therefore steel stampings are used in the best machines, because they can be trusted. There is every temptation to use the casting, for it costs only 3d. or 4d. per pound, and it requires very little work upon it before it is ready for use; and moreover, as very little metal is cut away from it, there is much more usable material in the pound of castings than of stampings. The steel bars for these latter will cost about 9d. per pound, and from the bars they have to be struck out into the requisite shapes by massive stamps. The "blank," as it is called, for a hub, for instance, will weigh about six pounds; it is passed through ingenious and expensive machinery, and subjected to skilled labor, and the finished article will weigh about five ounces. When it is considered that a similar process is followed for many other parts of the bicycle, it will readily be seen that, although a fairly reliable bicycle can be bought for about £10 or £12, it is not surprising that for a machine of the highest class, with the watchlike accuracy and perfect finish which is now attained, £18 or £20 should be asked. Some makers compromise by using malleable castings for the less important parts; but a few of the best makers do not use a scrap of malleable metal in their machines. On the question of the price of cycles, it has been pertinently asked why it is, if English prices have been inflated, that foreign makers, who have long been building some excellent machines, did not come over and undersell the home manufacturers. There was no tariff to stop them; and patriotism has not prevented the Englishman, in the case of other articles, from buying foreign wares if he could get them cheaper than and as good as his countrymen's produce. Evidently the margin of profit was not sufficient to tempt the foreign maker.

There is, however, some reason to anticipate that the prices of cycles will fall somewhat next year. In the first place, the charges have been undoubtedly excessive in the past season, owing to the enormous "boom" which flooded the factories with orders which they could not complete. Machines could not be turned out quickly enough, material was not to be had, and consequently eager purchasers had to take what they could get and pay a high price for it. Secondly, as a natural result, newcomers flocked into the trade; "small" men have done business which has caused them to prepare for bigger trade next year; while the old-established firms, inundated with demands, have launched out into all sorts of extensions, and have made contracts to enable them to secure largely increased outputs for 1897. Thirdly, there is the foreign invasion, chiefly American. The Americans had their boom a year or two ago, and built huge factories; they have evidently had plenty of stock on hand, and they have seen their opportunity to establish a trade by supplying those whom the English manufacturers could not satisfy. They have got a firm footing now, not only here but abroad, in parts where the Englishman might have contested the position with them if he had not been swamped by his prosperity. They will certainly have to be reckoned with as factors in next year's trade; and as they are preparing for increased output also, unless the "boom" not only continues, which it will almost certainly do, but also increases very much, which is not so sure to happen, there is a great possibility of our being overstocked. And in that case prices will fall, although the man who is waiting to buy a first-class machine for about £8 or £9 will have his savings by him for some years yet.—London Telegraph.

Country Houses and Polluted Wells.

The danger attending the taking of houses in the country for the summer season without making full inquiry into the water supply has frequently been alluded to in these columns. Nearly every farmhouse derives its water supply from a shallow well, and it is only too commonly known that in the great majority of cases the water obtained therefrom is more or less seriously polluted. Unfortunately, in consequence of the present state of the law, these wells can only be closed by a magistrate's order, and then only if there be proof that the water is actually injurious to health. For this reason the efforts of the most energetic medical officers of health and sanitary authorities to obtain purer water supplies are often frustrated. From time to time, however, cases occur in which the owners of such houses have to pay dearly for neglecting to provide proper water supplies. Within the last few days such an instance has been reported. A man hired a farmhouse in Essex for a season and sent down his family. The children were first attacked with diarrhœa; then one became more seriously ill and was found to be suffering from typhoid fever, from which the child unfortunately died. The water, upon examination, was found to be polluted, and the parent of the deceased child commenced an action in the Queen's Bench Division against the owner for damages. Lord Russell, in summing up, said there were two questions for the jury to consider: (1) Was the water so polluted as to be unfit for human use? and (2) Was the illness of the children caused by the polluted water? The evidence was of the usual contradictory character, but the jury decided in the affirmative on both points and awarded the plaintiff £75 damages. The conclusion of the case was in one sense satisfactory, but no amount of damages can compensate for such a loss. Still, the fact that farmers and others who let such houses are liable to be mulcted in damages for illness caused by drinking water from their polluted wells cannot fail to produce a salutary effect. Before renting rooms in such places the quality of the water supply should be carefully inquired into, and where there are grounds for the slightest suspicion the place should be avoided unless some certificate is produced from a medical officer of health or other competent person, who has not only examined the water, but also investigated the source from which it is derived, to the effect that it is safe for use for domestic purposes. If this precaution were taken, not only would the health of the visitors be safeguarded, but farmers and others letting such premises would seriously endeavor to provide supplies of water above suspicion. This is no imaginary danger, and the father of a family who ignores it has himself chiefly to blame if disastrous results follow the neglect of such a simple precaution as we have indicated.—The Lancet.

Natural Cold Storage.

The Spectator tells how Mr. Henry Seebohm, a famous English ornithologist, surprised from Nature her secret and discovered her great cold storage system.

In the course of his researches he was led to visit the Petchora River, which flows from the Ural Mountains into the Arctic Ocean near Nova Zembla. Along the lower part of the river he found what seemed a most uninviting district—an uninhabited, treeless swamp, stretching on either side of the stream, and known as the tundra. Higher up the river was the great Siberian forest, but here in the tundra was nothing but hard, frozen snow. Yet this unattractive spot was found to be the summer home of half the bird population of the Old World.

Mr. Seebohm reached it in the beginning of April. Forest and tundra were as bare of life as the Desert of Sahara, but a change was coming. Suddenly summer broke over the scene, and with it came the birds. The ice in the river split and disappeared, the banks steamed in the sun, and innumerable birds of all sizes and colors appeared within forty-eight hours after the first warmth.

The once frozen tundra now showed itself to be a moor, with here and there a large bog and numerous lakes. It was covered with moss, lichens, heath-like plants, dwarf birch, and millions of acres of cloudberries, cranberries, and crowberries. This was the storehouse of the feathered tribes.

The perpetual sun of the Arctic summer causes the plants to bear in wonderful profusion, so that fruit is abundant. But fruit bearing does not come before blossoming, and blossom and fruit cannot be perfected in forty-eight hours. The little travelers were arriving by thousands. The fruit would not be ripe until the middle of or end of the Arctic summer, and if the birds had to wait till then they must needs starve.

Not so, however, does Nature provide for her pensioners. Long before the snow melted provision had been made for their maintenance. Beneath the snow lay the whole crop of last year's fruit, perfectly preserved by Nature's system of cold storage.

Each year, when the berries are ripe, and before the birds can gather them, the snow descends upon the tundra, effectually covering the crop and preserving it in perfect condition until the spring sun melts the snow and discloses the bushes loaded with ripened fruits, or, in some cases, the ground beneath the plants covered with the fallen treasure, waiting for the hungry strangers.

Street Railway Fares.

Extraordinarily low rates per mile are indicated by the distance for which a passenger may ride for a single five cent fare, by the use of transfers, on some of the street railways, as may be seen in the following table compiled by the Street Railway Journal:

City.	Track mileage.	Miles for 5 cents.	Rate per mile.
New York	458	12·5	0·0040
Chicago	760	15	0·0033
Philadelphia	462	11·75	0·0043
Brooklyn	393	18	0·0028
Boston	275	9·9	0·0051
St. Louis	335	15	0·0033
Jersey City-Newark	175	8·25	0·0060
Cincinnati	263	10	0·0050
Milwaukee	159	9	0·0056
Denver	212	11·5	0·0043

Brooklyn appears to take the palm by giving an electric railway ride of 18 miles for 5 cents, but Chicago beats this in the case of a steam road which carries passengers a straight trip of 21 miles for a single nickel, and goes to the expense of printing, selling, collecting and auditing a ticket for each trip also. But, taking the average distance traveled, street railway rates are not so remarkably low compared with those of steam roads, for an immense number of their fares are received for short trips of 1, 2 or 3 miles, for which 5 cents is a profitable rate, and passengers are constantly leaving and arriving on every run through a populous city. On the long runs the business would be done at a heavy loss were it not for the large returns from the short trips.

AN inscription has been put on the Matterhorn reading: "Notice.—This hill is dangerous for bicycles."

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THE CALUMET AND HECLA COPPER MINE.

BY WILLIAM P. KIBBIE.

The Calumet and Hecla Mining Company, proprietors of the richest copper mines on the face of the earth, employ upward of five thousand men. The monthly pay roll reaches the enormous sum of $400,000. Its annual receipts average $14,000,000, from which dividends at the rate of $20 per share are annually declared, and have been paid with but few interruptions during the past ten years. The total dividends paid by the company since its organization in 1867 amount to about $46,350,000.

The total receipts of the company to date amount to more than $365,000,000.

The official statement of the company for the year 1894 was as follows: Amount invested in real estate, $6,354,690.40; amount of personal estate, $6,054,216.16; unsecured or floating debt, $812,123.99; amount due corporations, $5,464,670.59; production of refined copper, 79,769,293 pounds.

The belt of the Calumet copper-bearing conglomerate lies in Township 56, north of Range 33, west of the meridian of Michigan. Overlying the vein is a cupriferous amygdaloid rock, while its floor or footwall is composed of trap rock. "The first original opening to discover this vein and determine its value" was made in the latter part of August and the first ten days in September, 1864, under the superintendence of Mr. John Hulbert. The report of the discovery of the Calumet conglomerate was made by Edwin J. Hulbert to a Mr. Weeks, secretary of the Hulbert Mining Company, on the 10th day of September, 1864. The first barrel of conglomerate was shipped away on September 11 of the same year, when it was sent to Boston parties to test the truth about the vein carrying 4 per cent copper. The first active mining by the present company was begun in 1867, in which year the initial shipment of 768 tons of copper was made. From that year the product of the great mine kept on increasing, till now the annual shipment has reached the enormous weight of 95,466,478 pounds of copper.

To illustrate the position which this company holds on the copper market it may be mentioned that, of the 64,870 short tons of copper mined on the lake during 1895, the Calumet and Hecla produced 38,720 short tons, or more than one-half, and taking the combined product of all the Lake Superior mines since 1856 up to the present year, we find that the Calumet and Hecla has produced two-thirds.

The conglomerate formation in northern Michigan, extending from Portage Lake northwesterly to Keweenaw Point, and thence across Lake Superior to Ontonagan, is a conglomeration of pebbles in solid form with an intermixture of pure native copper. The productive part of this master vein lies in the southeast quarter of Section 14 and the northeast quarter of Section 23, South 56, Range 33.

The method employed in mining this vein is as follows: The shafts proper, which reach to the bottom of the mine, are timbered from base to summit, pine timber being used clear through. Levels are uniformly ninety feet apart, which afford access to the different parts of the mine. Through these levels the copper rock is brought to the main shaft by tram cars, that switch to and from the different openings. At the intersection of each level the ore is dumped into the skip, which runs up and down the main shaft at a speed of 600 feet per minute. At the summit the skip rises to the top of the rock house, where the ore is automatically dumped into the ore crushers, thence into the ore cars, whence it is carried to the mills for treatment. The vein is punctured by diamond drills, the average depth of each hole being five feet. Into these holes are inserted dynamite cartridges, at the end of which a cap is fitted. Attached to the cap is a length of fuse—ten feet. When this is all in readiness the bed is charged and fired, and the broken conglomerate is loaded into the tram cars, which convey it to the skip road.

METHOD OF TIMBERING IN THE CALUMET AND HECLA COPPER MINE, 4,650 FEET BELOW GROUND.

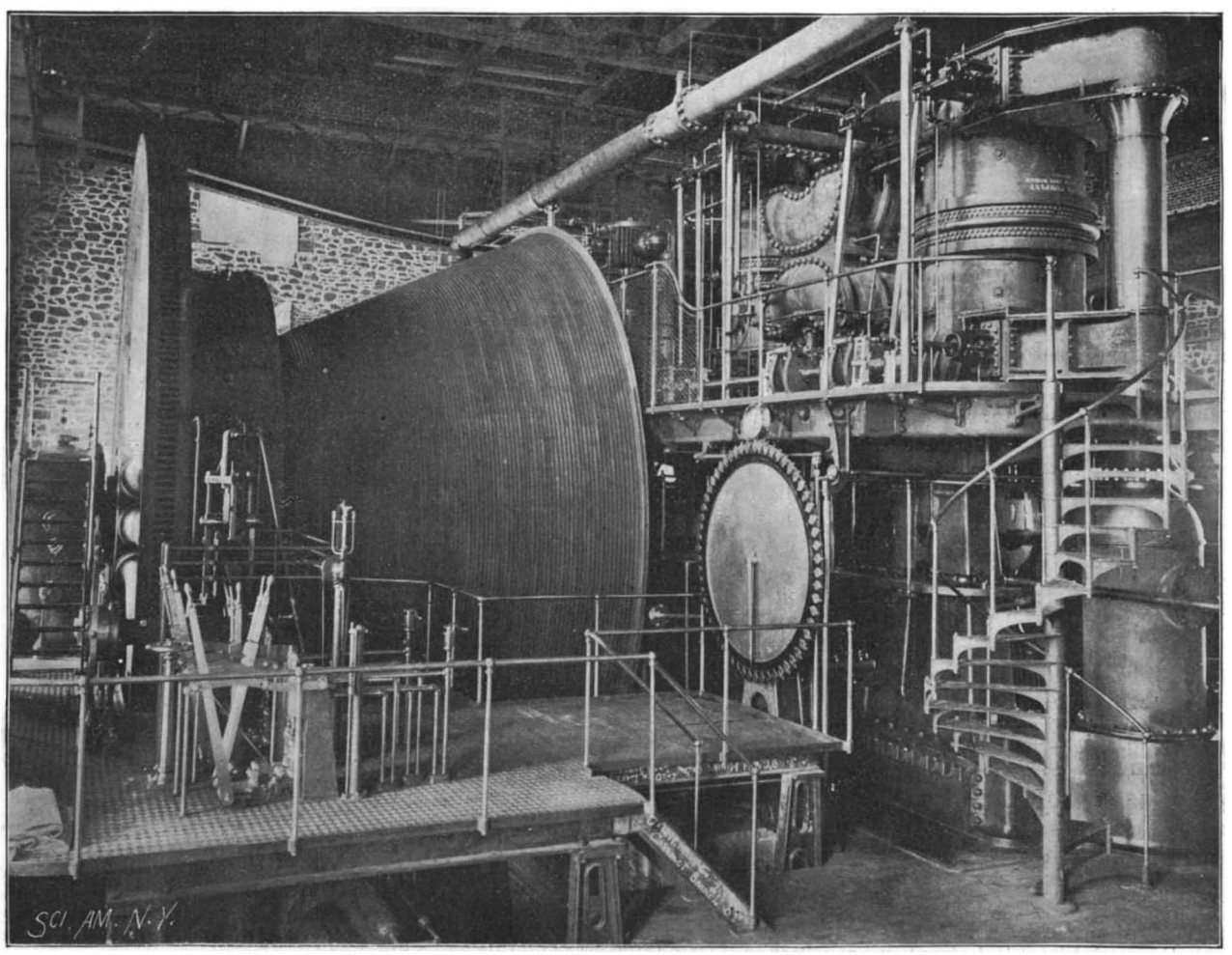
In the Calumet and Hecla mine, some seventy drills are operating, and they blast twice a day.

During the forty years of mining on the conglomerate the bed, which averages 12 feet, has never lost its width, while its thickness ranges between 15 and 25 feet. The width and thickness of the amygdaloid vein, however, are very uncertain. Sometimes they are found to measure 25 feet across, while at other times but a few inches. The conglomerate is a dull red in color, while the amygdaloid is a dirty gray.

The characters of both lodes are such that the most economical way to mine them is by slopes. By slopes is meant inclining toward the vein and under it near the foot wall, and working obliquely around it.

Calumet and Hecla Surface Workings.—Looking over the surface workings of this great mine, one is impressed with the idea that he is inspecting a literal exposition of machinery. No other mining company can begin to cope with it in the amount of horse power employed. The great Superior engine of 4,500 horse power; the twin engines, Minong and Mesnard, of 3,000 horse power each; the four triple expansion engines of the Red Jacket shaft, having a combined capacity of 8,000 horse power; the South Hecla engines of 5,000 horse power, and the grand array of other machinery, including electrical and hydraulic, makes the visitor wonder if so much grand mechanism is necessary. The surface workings cover an area of two and one-half miles, which is completely dotted with imposing structures, behind whose four walls grind day and night the ponderous machinery, and above which tower the huge smokestacks, built of solid masonry, some of them lifting their heads 255 feet into space.

(To be continued.)



4000 HORSE POWER TRIPLE EXPANSION HOISTING ENGINE, CALUMET AND HECLA COPPER MINE.

Origin of Tattooing.

What is the origin of this usage? Religion, which has so much power over peoples and which proves so obstinate in preserving ancient customs, has certainly contributed to maintain it among the more barbarous part of our populations; we see a quasiofficial proof of it at Lorette. Those who cultivate a devotion for a saint believe that by engraving his image on their flesh they will give him a proof, a clear testimony, of their love. We know that the Phenicians marked the sign of their divinity on their foreheads (Ewald, Judaischen Alterthum, iii). In the Marshall Islands they have to ask the permission of the gods to tattoo themselves, and the priests alone in New Zealand perform the office of tattooing (Scherzer). Lubbock adds to this that a woman who does not wear a tattoo mark cannot enjoy eternal felicity. The women of Britain tattooed themselves in obedience to religion (Pliny, 33).

The second cause is the spirit of imitation. A Lombard soldier answered me laughingly one day when I rallied him on his having spent a small sum to spoil his arm: "See, monsieur, we are like sheep, and when one of us does anything we all imitate him at once, even if we risk doing ourselves harm."

Love of distinction also has its influence. A thief of the most incorrigible sort, who had six brothers tattooed like himself, implored me, although he was half covered with the oddest tattoo marks, to find him a professional tattooer to complete what might well be styled the embroidery of his skin. "When the tattooing is very curious and spreads all over the body," he told me, "it is to us other thieves like the black coat of society with decorations—the more we are tattooed, the more we esteem one another; the more a person is tattooed, the more influence he has over his companions. On the contrary, one who is not tattooed has no influence; he is regarded simply as a good fellow, and is not esteemed by the company." — Appletons' Popular Science Monthly.

TUBERCULOSIS is affected by the Roentgen rays, according to MM. Lortet and Genoud's report to the Academie des Sciences. They inoculated eight guinea pigs with tuberculosis virus, then exposed three of them for an hour daily to the rays during eight weeks. The five who were kept from the rays developed abscesses and their health was deranged. The three kept in good health and grew fat on the rays.

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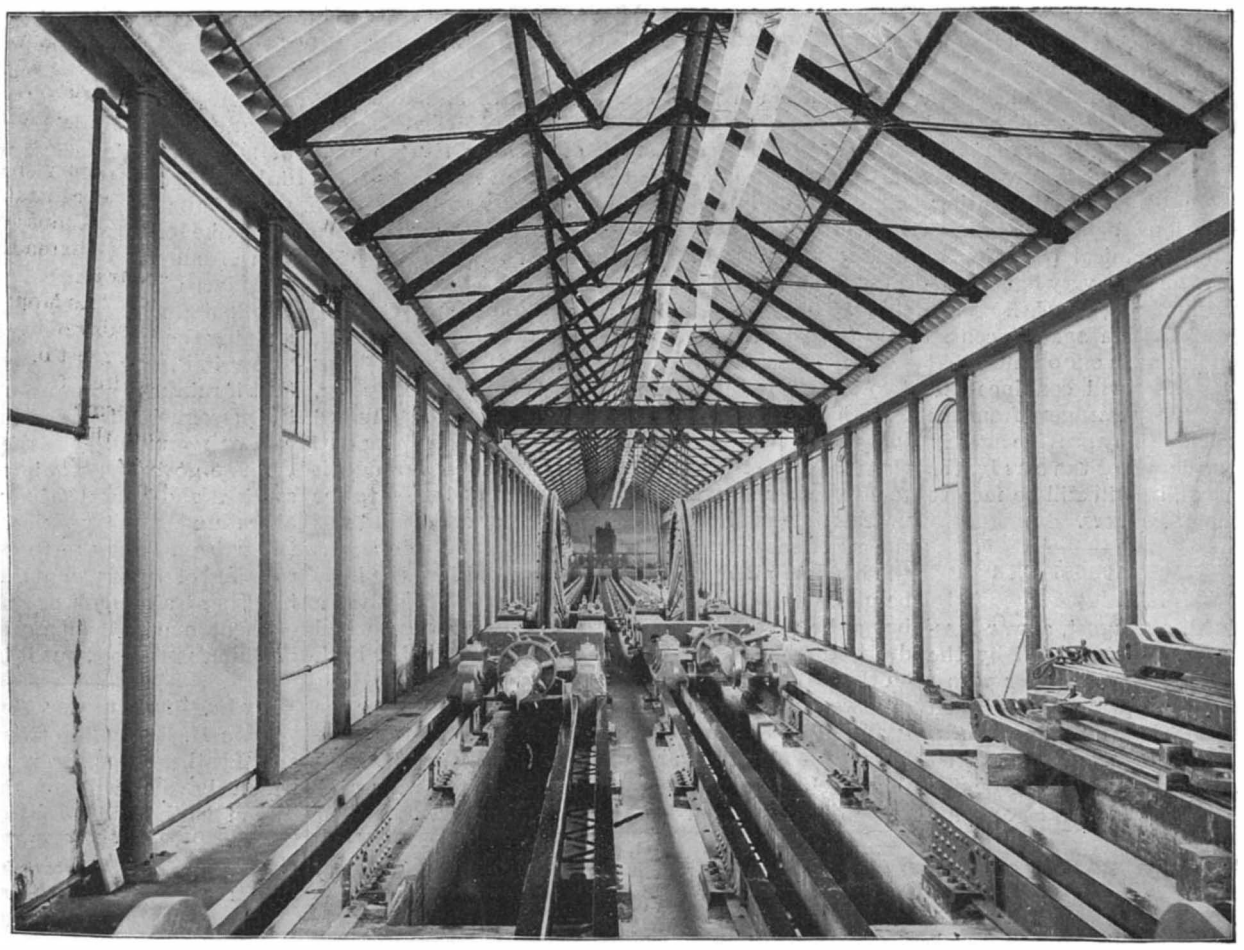
LIGHTNING EXPRESS RAILWAY SERVICE.

This proposed single rail line of Mr. F. B. Behr for speeds of 150 miles per hour has been exhibited in model at Windmill Street, London, W., but we are unable to see more in it, says the Electrical Review, to which we are indebted for the cut and particulars, than we did when the subject was put prominently forward some time ago. We have no fault to find with the working out of the arrangements as shown by the model as far as they go, but, so far from being a single rail line, this is really a five rail track, and yet a sixth is needed to make it really safe. The Behr railroad consists of a single bearer placed on a series of ∧ frames. On this rail the carriage runs on a single line of wheels, bicycle fashion, and the carriage hangs from the axles of these carrier wheels on each side of the ∧ frames. The electric motor is placed as low as possible, and every effort made to keep the C.G. low. On each side of the ∧ are placed two rails on which run guide wheels. These wheels are, of course, horizontal, and serve to take lateral stresses at curves. It is clear, however, that the C.G. of the vehicle is above these wheels, so that in rounding a curve the stress will be borne by the upper guide wheel on the concave or inner side and by the lower wheel on the outside of the curve. Weight alone keeps the carriage down on the top rail, and we cannot but fear there will be great risk of the carriage rising somewhat on rounding a curve, when the guide wheels will slip off the lateral rails. In fact, we quite doubt the suitability of the line for its special purpose of high speeds, and consider it far more fitted for moderate duties. From Mr. Behr's own showing, the centrifugal force of a particle traveling round a 25 chain radius curve is, at 150 miles per hour, 1·4 times the weight of the particle. Now all this may be provided for in the vehicle, but not a word is said about passengers. Going round such a curve an average passenger of 150 pounds weight would be forced to the outside of the curve with a pressure of 210 pounds. It would be all right for the passengers on the outer side, but the inside, or, as we will term them, the concave passengers, would simply be flung across the car upon their vis-a-vis, and this, however pleasing under certain circumstances with curves of fairly flat radius, would be extremely dangerous with the sharper curves. Now Mr. Behr absolutely ignores the passengers. Superelevation of the track, or the Behr equivalent of superelevation, will not help the passengers much. Full superelevation would simply make a passenger sit tight to the tune of his own weight plus 1·4 times his weight. The present writer would weigh 360 pounds for the nonce. Our worthy editor in such a case would weigh about 520 pounds. These are serious figures. They show what great overturning efforts are made upon the structure. We think, too, that Mr. Behr is far too hopeful when he assumes that the centrifugal and wind stresses will be distributed over a length of 500 feet, or ten times the car length.

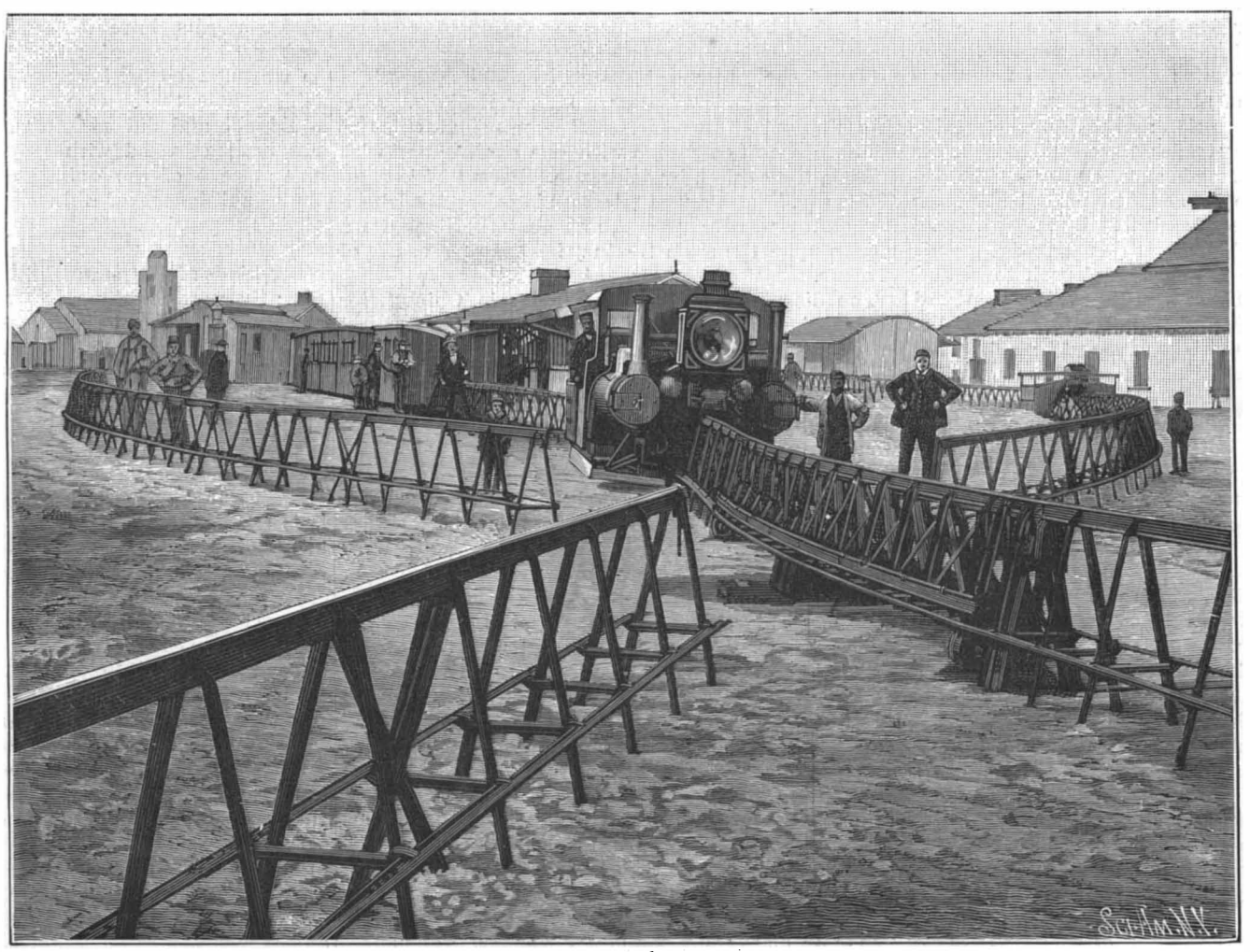
If, therefore, this system is to be of any practical use for high speeds, the curves must be of great radius and the line generally as straight as possible. But when we have got to this we find that such conditions are eminently suitable for the ordinary railway whose trains do not leave the track at high speed on straight portions, and whose simplicity and cheapness of construction far exceeds that of the Behr system. Again, as regards accident, we cannot, despite Mr. Behr's argument, admit that the risks are anything so light as he infers. We do not care to contemplate the fearful result of a failure in the continuity of the structure with the central rail running as it does through the center of the car. An accident might be productive of most serious mixing up of the iron structure, the car and the passengers. The fact is that Mr. Behr has paid so much attention to the mathematics of the mere structure, looked at as a girder, that he has overlooked that passengers are not part of the general structure and cannot be thus mathematically disposed of. As a mere question of stability and strength, such a line can be established just as easily as any other girder structure. There is no limit to speeds for Behr's system if suitably constructed to carry goods properly packed, but passengers cannot be so packed for ordinary traffic. If high speed is demanded and passengers would pay for it, they could be carried lying down, and in this way alone the stress per unit of length would be moderate, but the same outlay would build a straighter line, and the virtue of the Behr system would be gone. For a light line, winding in and out of crooked places and at moderate speeds, we think there is room for the system, electrically worked or otherwise, but more than this we do not care to say.



RED JACKET SHAFT TAIL HOUSE, CALUMET AND HECLA COPPER MINE.
412 FEET LONG BY 32 FEET WIDE.

However, Mr. Behr's method has been public property for several years, and we have pleasure in reproducing a view of the Listowel & Ballybunion Railway in Ireland, which has been constructed on the system, but has so far been worked by steam locomotives at low speeds. With a view to the system being adopted for electrical working, a trial track of three miles is to be laid down at Brussels so as to be ready for the exhibition of next year. This line will take the form of an oval with circular ends of 550 yards radius, and the speed is said to be guaranteed to 95 miles per hour. Mr. T. Parker, of Wolverhampton, is, we believe, to have the design and management of the electrical details.

As regards the general arrangement of the car, this has now been arranged so that the seats are above the apex of the rail structure, and the general center of gravity of the whole is brought low by placing the motors in the lowest part of the carriage sides, connecting them up so as to partake of the motion of the springs while maintaining a fixed distance between the center of the armature and that of the axles. From the pamphlet supplied to us, it appears that cars of 50 feet are intended, carried on bogie trucks and with motors equal to 600 horse power each car. At 2 feet 3½ inches below the surface of the apex rail of the trestle structure there is cross bracing, and on each side of the trestle guide rails, four in all. Where a road



VIEW OF LISTOWEL AND BALLYBUNION RAILWAY IRELAND—LARTIGUE SYSTEM.

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or river is to be crossed the structure is suitably trussed to act as a bridge, and piers are provided where necessary. For changing over from one line to another, a piece of the structure is made to swing upon a turntable.

The latest suggested vehicle is one of which the body is articulated to enable it to travel easily on curved portions of the line. It would run on 12 bearing wheels and seat 135 passengers, with space for their luggage, and would weigh in full working order 60 tons, including 10 tons of passengers, each articulated length weighing 20 tons and being 25 feet long. The speed is moderated to 110 miles per hour and the curve radius is made 35 chains. Evidently the odd figures of 150 miles and 25 chains radius are being found wanting. In Mr. Behr's model the various details are nicely worked out, and there is no mechanical objection to the running of such a railway, but the very figures advanced by him and his care in putting the C.G. as low as possible, and generally his provision against centrifugally produced stresses confirm us in our opinion that further consideration of the same will convince Mr. Behr that he cannot separate the passengers from the vehicle, and that however much he may provide against the stresses set up in the structure or the cars by the use of high speed round curves, he will still be face to face with the difficulty of the passengers.

THE BICYCLE RELAY RACE ACROSS THE CONTINENT.

At noon on the twenty-fifth of August, a war message and a post office dispatch were intrusted by the government authorities to a bicycle relay for transmission across the great American continent. Thirteen days later the last of the 220 couriers reached New York, the eastern terminus of the trip and unslung the scarred and weather beaten wallet from his shoulders, the distance of 3,400 miles having been covered at the average speed of about 11 miles an hour.

The relay race, by far the greatest thing of its kind ever undertaken, was organized by the San Francisco Examiner and the New York Journal. It was also aided by the co-operation of the war and post office departments, and by the great railroad systems which extend along the route followed by the relay. These were the Southern Pacific Railroad, from San Francisco to Ogden; the Union Pacific, from Ogden to Council Bluffs; the Chicago and Northwestern, from Council Bluffs to Chicago; the Lake Shore and Michigan Southern, from Chicago to Buffalo; and the New York Central, from Buffalo to New York.

The management of these roads instructed their station agents and operators to report the passage of the relay both to this city and to San Francisco. The work of organizing the relay, which occupied three months, was carried out by Mr. A. R. Grant and Mr. Henry Doyle, who twice made the trip across the continent for this purpose. The route, 3,400 miles long, was divided into 220 relays of an average length of about 15½ miles. Two riders were assigned to each section: a courier, who carried the package, and a "trailer," who followed close behind him, to render assistance, and carry the dispatch forward in case he should be disabled. Four hundred wheels were furnished by the Stearns Company, and were distributed at different points along the route. The postmaster of each town and the governor of each State through which it passed were notified of the probable time of arrival of the relays; so that they might be on hand to affix their signatures and official stamps to the two messages. As far as possible, the posts were located in towns and hamlets; but in the nature of the case it often happened, as in the passes of the Rocky Mountains and on the broad deserts of the West, that the posts had to be established far from any habitation. In this case the relay men were furnished with blankets and provisions and dispatched to their solitary posts to await the flying dispatch.

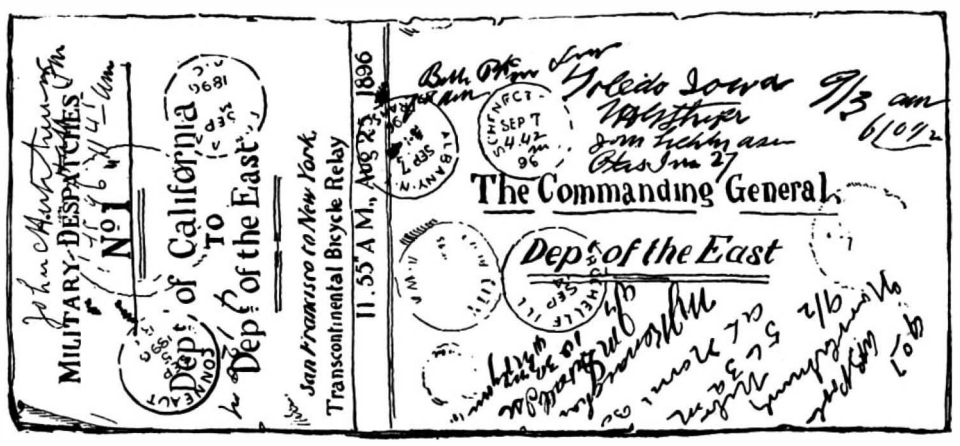
The stout leather wallet, which was slung by a strap across the shoulders of the riders, contained a sealskin case, within which was a sealed envelope containing a gold plate, engraved with a war message from the commandant at the Presidio, a military post at San Francisco, California, to the commandant at Governor's Island, New York. On one side of the case was a strip of ruled parchment, for the signatures of the governors of the various States through which the relay passed. The post office department also instructed the postmaster at San Francisco to forward a special message by the bicycle relay to the postmaster at New York, and gave instructions to the local postmasters at the various towns to place their signatures and stamps upon the letter.

Our illustration, for which we are indebted to the courtesy of the New York Journal, shows the envelope containing the war message.

The story of the relay, as told by the gentlemen who followed it by train, is full of thrilling interest; and while the palm for speed was naturally carried off by the riders on the turnpike roads of California and some of the Middle and Eastern States, where speeds of over 20 miles an hour were sustained for stretches of from 10 to 20 miles, the credit for courage and persistency must be accorded to the men who rode up and down the steep and rough grades of the Rockies and across the alkaline deserts of the far West.

Naturally the trip was full of mishaps, though none of the riders was crippled or received more hurt than abrasions and bruises—a surprising result, when we bear in mind that one-third of the distance was ridden in the night. A notable case was that of Courier Erswell and his "trailer" Deitrick, of Cheyenne, Wyoming. They were riding by night and in a blinding rainstorm by a road which crossed a swollen torrent, whose bridge, a corduroy affair, had been washed out two or three hours before they reached the crossing. The riders, speeding on through the darkness, plunged into the river, first courier, then trailer. Climbing out, they used a fence rail with a spike driven through it to fish out their wheels, and then rode 36 miles to the nearest telegraph station. Quite of another kind was the experience of a courier in his 43 mile ride across the burning alkali desert, who staggered into the little hamlet at the end of his run and requested that a buggy be sent for his exhausted companion, who had dropped from sheer fatigue some 10 miles further back on the trail.

Eastern riders, who are accustomed to glide over the level surface of macadamized roads can appreciate the task of the mountain and desert relay when it is stated that the message was carried across two ranges of mountains, 7,000 and 8,000 feet high, and over so-called roads that for hundreds of miles had no more title to the name than has a sheep trail through an Eastern farm. In many respects this is the greatest feat that has ever been accomplished by that mechanical marvel of the day, the bicycle.



THE ENVELOPE CONTAINING THE BICYCLE RELAY WAR MESSAGE.

How the Chinese Language is Telegraphed.

According to the "Statesman's Year Book," says the San Francisco Chronicle, all the principal cities of China are now connected with one another and with Peking, the capital, by telegraph. Recent visitors to China say, however, that telegraphing there is a laborious and expensive process, and that the lines are a charge upon the state treasury instead of a source of revenue.

The dispatches are, of course, sent in Chinese, for not one in many thousands of the natives knows any language except his own. But the Chinese have no alphabet. Their literary characters, partly ideographic, partly phonetic, number many thousands. It is simply impossible to invent telegraphic signals that would cover the written language. Here was an obstacle in the way of using the telegraph at all.

The difficulty was obviated by inventing a telegraphic signal for each of the cardinal numbers, and so numbers or figures might be telegraphed to any extent. Then a code dictionary was prepared, in which each number from one up to several thousand stood for a particular Chinese letter or ideograph. It is, in fact, a cipher system. The sender of the message need not bother himself about its meaning. He may telegraph all day without the slightest idea of the information he is sending, for he transmits only numerals.

It is very different with his friend, the receiver. He has the code dictionary at his elbow, and after each message is received he must translate it, writing each literary character in place of the numeral that stands for it. Only about an eighth of the words in the written language appear in the code, but there are enough of them for all practical purposes.

But the Chinese system has its great disadvantages. Men of ordinary education have not sufficient acquaintance with the written language to be competent receivers, and the literati are not seeking employment in telegraph offices. So the government recruits its employes with much difficulty. There are almost no Chinese who have business relations all over the country, as is the case with many thousands of our business men. The public is not invited to buy stock in the Chinese telegraph lines, and if it were, nobody at present would buy with a view to dividends. The receipts do not equal the expenses, and the government makes up the deficit.

There is another great disadvantage of the Chinese telegraph system. All over the world the movement of railroad trains is regulated by telegraph. The orders received by the station agent are filed in plain view of the employes, and if need be the switchman may take temporary charge and carry out the instructions from the central office. Railroads have been introduced into China to a very small extent, and there is talk of greatly extending the service. But how about running the trains?

A writer in "Le Mouvement Colonial," of Paris, says that if railroads are introduced to any extent in China, the personnel must be exclusively European and American, or recruited from the literary class. He says the Chinese government will not take foreigners into its service, and that the educated men of China, who alone among the people have sufficient knowledge of the written language to be intrusted with the actual running of trains, would refuse most emphatically to be either train hands or station agents.

This is one of the many stumbling blocks in the way of China's progress, but it is quite effective in its way.

Inventions in the Shoe and Leather Trade.

Isaac H. Bailey, for twenty years editor of the Shoe and Leather Reporter, notes that "the improvements which have been brought about in the manufacture of leather and shoes are far more wonderful than is generally realized," and says: "But, after all, the inventors hold the lead in the creation of amazing auxiliaries to industry. They have contrived machinery in illimitable quantities, which performs labor with such absolute precision that they have revolutionized the whole domain of mechanism. They have amplified the facilities for shoe production to such a degree that they have lowered the cost and bettered the quality of shoes astonishingly. . . The skill which has been displayed in the manufacture of kid is surprising. A few years ago most of this material was imported, because of the superiority of the foreign over the domestic fabric. This current of traffic has been completely reversed. We are now exporting large and increasing quantities of kid of as good quality as was ever made. The demand for it abroad is increasing rapidly, and the consumption in our own land and in others has attained prodigious proportions. These results have been wrought by the genius and perseverance of men who devoted themselves to study and experiments with an assiduity so unfailing that there were no difficulties which they could not and did not surmount. Their persistency has been crowned with substantial rewards in the enlargement of the outlets of consumption and in the establishment of a business which is susceptible of wide expansion. There has been also a considerable augmentation of the exports of pretty much all the other kinds of leather, and the sales of them multiply fast; they are doubling every ten years. The exports of shoes have been insignificant hitherto, but they are growing apace, and are likely to become comparatively extensive in the course of time. Our manufacturers are making conquests in Europe, and American shoes are favorites in the best appointed retail stores in many of the leading cities of the old world. The efforts to secure this trade were only begun a short time ago, and they have already been rewarded so satisfactorily that it is probable, if not certain, they will be continued, and that solid advantages will accrue from them."

The Cyclone in Paris.

A cyclone of extraordinary violence burst over Paris, France, about ten minutes before three on the afternoon of September 10. Although the duration of the cyclone was not greater than one minute, still during that time two people were killed and about fifty were injured. Much damage was done to property in the city. Many of the trees which add so much to the beauty of Paris were snapped off as if they had been cut by a scythe. The smaller trees seemed to have survived the shock better, but even they were greatly injured. Cabs were upset, street lamps were broken, barges were sunk. The roof of the Opera Comique was much damaged, and the Palais de Justice was almost wrecked. Rain fell in torrents and traffic was stopped for two hours.

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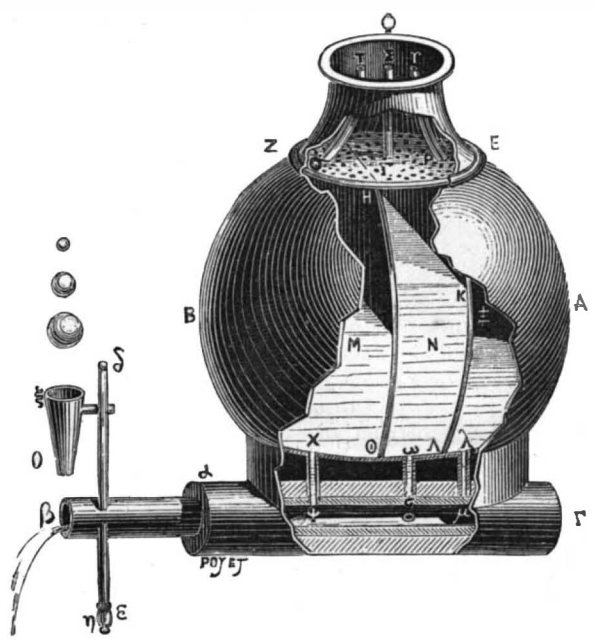
THE MAGIC BOTTLE.

The apparatus represented in the accompanying figure presents an arrangement similar to that of the inexhaustible bottle of Robert Houdin, but it is more ingenious. The problem proposed, as enunciated by Heron, the Greek engineer, who describes the apparatus, is as follows: Being given a vessel, to pour into it, through the orifice, wines of several kinds, and to cause any kind that may be designated to flow out through the same orifice, so that, if different persons have poured in different wines, each person may take out in his turn all the wine that belongs to him.

Let *A B* be a hermetically closed vessel whose neck is provided with a diaphragm, *E Z*, and which is divided into as many compartments as the kinds of wine that it is proposed to pour into it. Let us suppose, for example, *H Θ* and K A are diaphragms forming the three compartments, *M*, *N*, and Ξ, into which wine is to be poured. In the diaphragm, *E Z*, there are formed small apertures that correspond respectively to each of the compartments. Let *O*, *Π* and *P* be such apertures, into which are soldered small tubes, *Π Σ*, *O T* and *P Υ*, which project into the neck of the vessel. Around each of these tubes there are formed in the diaphragm small apertures like those of a sieve, through which the liquids may flow into the different compartments. When, therefore, it is desired to introduce one of the wines into the vessel, the vents, *Σ*, *T* and *Υ* are stopped with the fingers, and the wine is poured into the neck, *Φ*, where it will remain without flowing into any of the compartments, because the air contained in the latter has no means of egress. But, if one of the said vents be opened, the air in the compartment corresponding thereto will flow out and the wine will flow into such compartment through the apertures of the sieve. Then, closing this vent in order to open another, another quantity of wine will be introduced, and so on, whatever be the number of wines and that of the corresponding compartments of the vessel, *A B*.

Let us now see how each person in turn can draw his own wine out through the same neck. At the bottom of the vessel, *A B*, there are arranged tubes, which start from each of the compartments, to wit: The tube, *χ ψ*, from the compartment, *M*, the tube, *ω σ*, from *N*, and the tube, *λ μ*, from Ξ. The extremities, *ψ*, *σ* and *μ*, of these tubes should communicate with another tube, *α*, in which is accurately adjusted another, *β Γ*, closed at *Γ* at its lower extremity and having apertures to the right of the orifices, *ψ*, *σ* and *μ*, so that such apertures may, in measure as the tube revolves, receive respectively the wine contained in each of the compartments and allow it to flow to the exterior through the orifice, *β*, of the said tube, *β T*. To this tube is fixed an iron rod, *δ ε*, whose extremity, *ε*, carries a lead weight, *η*. To the extremity, *δ*, is fixed an iron pin supporting a small conical cup whose concavity points upward. Let us therefore suppose this truncated cone established, its wide base at *ξ*, and its narrow one (through which the pin passes) at *θ*.* Again, one must have small leaden balls of different weights, and in number equal to that of the compartments, *M*, *N* and Ξ. If the smallest be placed in the cup, *ξ θ*, it will descend on account of its weight until it applies itself against the internal surface of the cup, and it will be necessary to so arrange things that it may thus cause the tube, *β Γ*, to turn so as to bring beneath *ψ* that one of the apertures that corresponds to it and that will thus receive the wine of the compartment, *M*. This wine will then flow as long as the ball remains in the cup. If, now, the ball be removed, the weight, *η*, in returning to its first position, will close the orifice, *ψ*, and stop the flow. If another ball be placed in the cup, a further inclination of the rod, *ε δ*, will be produced, and the tube, *β Γ*, will revolve further, so as to bring its corresponding aperture beneath *σ*. Then the wine contained in the compartment, *N*, will flow. If the ball be removed, the weight, *η*, will redescend to its primitive place, the aperture, *σ*, will be closed and the wine will cease to flow. Finally, upon placing the last ball (which is the heaviest), the tube, *β Γ*, will turn still more, so as to cause the flow of the wine contained in the compartment, Ξ.

It must be remarked that the smallest of the balls should be so heavy that when placed in the cup it shall outweigh the weight, *η*, and consequently bring about the revolution of the tube, *β Γ*. The other balls



THE MAGIC BOTTLE.

will then be sufficient to cause the revolution of the said tube.—Les Origines de la Science.

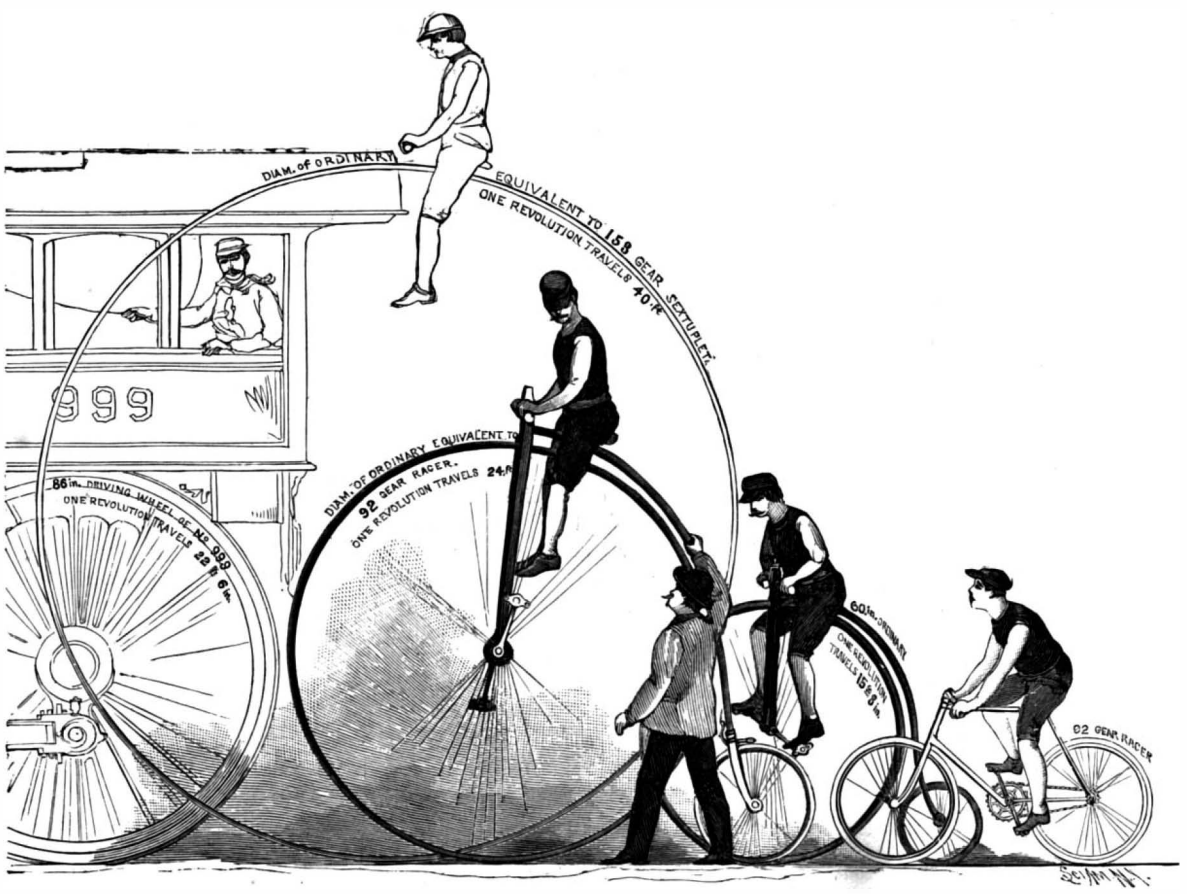
*The text does not agree with the figure given by the MSS. Moreover, there is an arrangement here that it is difficult to understand from Heron's description.

BICYCLE "GEAR"—WHAT IT MEANS.

In a discussion of the relative merits of their machines by two riders of the wheel, it is safe to say that after the invariable question, "What make do you ride?," the next will be, "What is the gear?" There is probably no feature of the wheel which is more discussed than this, or in which a wider difference of dimensions exists; yet, strange to say, there is no feature which is less understood.

There are thousands of riders who have no clear perception of the change of mechanical conditions which takes place when, by substitution of a smaller sprocket on the rear wheel, he "raises the gear" of his machine.

True, when he mounts and begins to apply pressure to the pedals, he is sensible of a change which in its effects is truly remarkable. If his first ride with the high gear be taken on a smooth and level road, for the first few revolutions of the cranks he will be disappointed, if not disgusted, at the sluggishness of the machine, and he will have to apply a much greater pressure to the pedals than was necessary on the old gear. When the bicycle is fully in motion, however, he will be agreeably surprised to find that, with the same speed of rotation of his pedals as with the low gear, and apparently with the same pressure, he covers what to his pleased and excited imagination appears to be fifty per cent more distance. His satisfaction will last until the first hill or a head wind is encountered, when all the life and mettle will suddenly die out of his "high gear" wheel, and to the redoubled pressure on the pedals there will be apparently but little response.


DIAM. OF ORDINARY
EQUIVALENT TO 158 GEAR SEXTUPLET
ONE REVOLUTION TRAVELS 40 FT.
999
DIAM. OF ORDINARY EQUIVALENT TO
92 GEAR RACER.
ONE REVOLUTION TRAVELS 24 FT.
86 in. DRIVING WHEEL OF NO. 999
ONE REVOLUTION TRAVELS 22 FT. 6 IN.
60 in. ORDINARY
ONE REVOLUTION TRAVELS 15 FT. 8 IN.
92 GEAR RACER

BICYCLE GEARS AND THEIR EQUIVALENTS.

For the benefit of those of our readers who may not have a clear conception of the part played by "gear" in the mechanics of the bicycle we have prepared the accompanying diagram. The comparison is based upon the proportions of the now extinct "ordinary," or high wheel, bicycle; and it shows how the introduction of the rear-driven "safety," with its multiplying gear, has increased the capacity of the bicycle in respect of the amount of ground which can be covered by one revolution of the pedals. In the old "ordinary" bicycle, in which the cranks were attached directly to the driving wheel, the diameter of driving wheel which a rider could use was determined by the length of his leg. For this reason a 50 to 52 inch wheel was the common size, and a 60 inch wheel was an object of positive wonder on the road or on the track. This was the size ridden by Dr. Cortis (the Zimmerman of those days) when in 1880–81 he astonished the world by riding 20 miles in one hour on the track. In those days it was largely the high velocity of the pedals that limited the speed, and every rider chose the largest wheel that he could comfortably bestride, without impairing his effective work on the cranks.

The introduction of the rear-driven safety bicycle, with its multiplying gear, has changed all that, and, as our illustration shows, the short rider can now bestride a bicycle the effective diameter of whose driving wheel may be greater than that of our swiftest express locomotives. In passing it may be mentioned that if the rider of a 72 gear safety were seated upon an ordinary of equivalent diameter his eyes would look out upon the world from a point some 9 feet above the ground, and the riders of the 153 gear sextuplet would look down upon the earth from an elevation of fully 16 feet.

The distance traveled for one revolution of the cranks of the largest ordinary bicycle is 15 feet 8 inches; for the 92 gear racer it is 24 feet; and for the 153 gear sextuplet it is 40 feet; and such has been the improvement effected by the rigidity of the safety frame, the better position of the rider for his work, the excellence of the bearings, and, above all, by the recuperative action of the pneumatic tire, that the cranks of the 92 gear, modern, racing bicycle can be propelled with greater ease than those of the old 60 inch ordinary machine; as the respective speeds attained by two types would seem to prove. But while this is true on the race track, where the riders are men of muscle and endurance, on the country road the advantages of excessively high gear are not so manifest. For although the rider of an 80 gear machine covers about a yard more ground than the rider of a 70 gear machine, at each revolution of his cranks, he has to exert theoretically one-seventh more pressure upon the pedals, provided the other conditions, such as length of cranks and weight of rider and machine, be equal. Upon the level and on good roads this extra pressure is not discernible, when once the machine is fairly under way; but upon a rough road, or in climbing a hill, or against the wind, the extra effort is very evident, and in the case of weak or tired riders, painfully so.

Broadly speaking, the question of "gear" is one of the lever, in which the radius of the driving wheel is the long arm, the crank the short arm, the resistance being applied at the long arm and the power at the short arm. When the machine is running at any given speed, the pressure on the pedal multiplied by the crank length will just equal the total resistance of the machine (due to internal friction, wind, the irregularity of the ground, and the inclination of the grade, if climbing a hill), multiplied by the theoretical radius of the driving wheel. Evidently, if the driving wheel, or gear, be increased, the length of the crank should be increased in like proportion if the pressure on the pedals is to remain the same; and in general it will be found advisable to do this. On the other hand, increased length of cranks means greater travel of the rider's leg, or increased "knee action," and an increased fatigue on this account alone.

As a rule, it may be said that the question of gear must be determined by the general make-up of the rider himself. The man of quick, nervous action will

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do better work with moderate gear and rapid stroke; while high gear and slower stroke will suit the more powerful but less active rider.

The Fire Loss in 1895.

To most persons the subject of fire losses is interesting, even if it does not appeal to them personally. For twenty-one years the Chronicle, the principal organ of the insurance interest in this city, has published tables setting forth the annual fire loss in the United States, and this year these tables, comparing similar losses in earlier years with those of last year in all parts of the country, are more interesting and illuminative than ever before.

In considering the loss by fire, insurance men look at the subject from two points. The property loss is one thing to them, the insurance loss is another. The first is the total loss; the second, the loss that falls upon the insurance companies. In brief, there were 38,003 fires in 1895, which destroyed 53,961 pieces of property; the total loss amounted to $142,110,233, and the insurance loss to $84,698,030. These amounts are enormous in themselves, but it is to be recorded that the average property loss and the average insurance loss were smaller than ever before, being $3,793 for the former and $2,228 for the latter, as against $3,938 and $2,530 respectively in 1894. That is, in 1895 the insurance covered 64 per cent of the loss, while in 1894 it covered less than 60 per cent.

In 1895 there were 22,711 fires in dwelling houses; next in number were the fires in stores and offices, which amounted to 12,543; livery stables, barns, and tobacco barns (a rather strange combination) came third, with 8,142 fires. Three hundred and two colleges, schoolhouses, and convents were burned, 503 theaters and public and private halls, and 340 churches. Manufacturing establishments to the number of 5,231, and hotels, clubs, and restaurants to that of 1,332, were injured more or less seriously by fire. Of the 53,961 pieces of property injured, 15,953 caught fire from exposure to fires originating elsewhere, and the loss caused by these 16,000 fires amounted to nearly $38,000,000—equal to more than 26 per cent of the total loss.

Naturally, the summer months show the lightest losses. May was the month of lightest property loss and June that of lightest insurance loss. The greatest insurance loss and the greatest number of fires occurred in October, seemingly because the furnace fires began to be lighted in that month. The greatest property loss, however, occurred in March; in that month occurred seven fires involving losses of more than $200,000 each, while three of them caused losses of more than $400,000 each.

The Western States provided a larger percentage of the fires than ever before, with 40·7 per cent to their account; the Middle States had 26·5 per cent. The fires in these two sections were more numerous than in 1894, but in the Eastern, the Southern, and the Pacific States the percentage decreased.

A table of especial interest is that showing the fires caused by electric wires or lights. Naturally, the question of electricity as a cause of fire did not come up very long ago; in fact, it is only for the ten years 1886–1895 that figures on the matter are to be had. In 1895 there were 249 fires caused by electricity, as against 217 in 1894; but the fires caused by exposure to those started by electricity numbered only 89, instead of 169 in the former year. So the total number of fires caused by electricity was 338 in 1895 and 386 in 1894, a very marked falling off. It is evident that greater care in insulating wires and in other matters connected with electrical plants is taken.

A table of the losses by their causes occupies a considerable part of the Chronicle's book and affords much of interest and instruction. Accidents caused 298 fires, 29 of them in the District of Columbia and 27 in New York State. Hot ashes and coals started 318 fires, and bonfires only 49, while burglars caused 65. Candles set 248 fires, and carelessness only 203, while children playing with fire were responsible for 71. Fires to the number of 536 were due to cigars, cigarettes, and tobacco pipes, while 3,607 were caused by defective flues. Of these, 358 were in Illinois and 331 in this State. Drunken men set 16 fires in 13 States. Explosions caused 3,051 fires; of these 6 were dust explosions, occurring in Illinois, Iowa, and Wisconsin. Fireworks and firecrackers caused 319 fires; incendiarism, 3,521; lightning, 839; and matches, 1,771. Mischievous children started 21 fires and natural gas 81, two of which were in New York State. The much maligned plumber caused only 61 fires with his furnace, while locomotive sparks set 427. Spontaneous combustion is held responsible for 521 fires, stoves for 1,546, and tramps for 268. Of unknown and unassignable origin were 5,981 fires, while 8,361 were not reported as insurance losses. A study of the cause tables enables the Chronicle to say that the inherent and common causes show each an increased percentage, while the indirect (of criminal and mischievous origin) and the unknown and unreported show each a decreased percentage.

In the twenty-one years covered by the tables 25 gymnasiums have been burned, 138 armories, 13 chambers of commerce and boards of trade, and 3,144 churches. In fourteen years 59,570 barns and stables were burned and 170,949 dwellings.

Fifty-seven grand stands have gone up in smoke; 73 artificial ice factories, 2,150 ice houses, and 51 refrigerator factories have succumbed in twenty-one years, and so have 941 theaters and opera houses. In four years 16 tin plate factories have been burned. On the other hand, the business failures and the fires do not maintain an even ratio, in spite of the humorists of the weekly papers; in 1895 there were 13,013 failures and 38,003 fires, while in 1894 the figures were 12,724 and 35,549; and in 1893, 15,508 and 35,188 respectively.

Not only did October, 1895, lead the months in the number of its fires, but it has led them in the matter for twenty years. During that time 33,995 fires started in October; December comes next with 33,806 fires.

During the past twenty years New York suffered a property loss of $320,003,720; Pennsylvania, one of $173,086,623; Illinois one of $125,735,034; and Massachusetts, one of $125,246,015. Ohio will be glad to be fifth in losses, with $121,180,936 damage.

The average loss at a fire was less in 1895 than ever before, but this was due to the absence of any very great fire; the actual number of fires was greater by 1,695 than that of 1894. The total loss during the twenty-one years considered in the tables amounts to $2,219,500,491. This is absolutely and entirely lost, an average of more than $100,000,000 a year. Such a loss demands serious practical consideration, but, says the Chronicle, "there does not seem to be very much hope of any material reduction, but rather of a gradual increase in the fire waste. The people would rather lose their property than to take effectual steps to preserve it."

Danger of Rinderpest in America.

There is considerable alarm felt in Canada over the much dreaded rinderpest, which it is thought may be introduced into that country through the medium of hides imported from South Africa. Protests have been made by the leading experts in Canada, but their warning has had no effect on the authorities as yet. Of course a similar danger exists of the plague being brought into the United States. Pleuro-pneumonia among Canadian cattle has been traced to infected hides imported from England. The danger from this disease is of course as nothing compared with the ravages wrought by the rinderpest, which is at present decimating so many of the herds in South Africa. When the disease last visited England, over 73,000 head of cattle were attacked by it and 41,000 died.

RECENTLY PATENTED INVENTIONS.

Mechanical.

SAW.—John Morrish, Mayville, North Dakota. For buck saws, hand saws, ice saws, etc., this inventor has devised a blade designed to smoothly enter the material without jerking or jumping, doing the most cutting on the forward stroke, and readily removing the dust in coarse pieces. The blade has groups of teeth separated by throats, each group having several cutting teeth and a rake tooth, the cutting teeth having no pitch at the outer end of the blade and gradually increasing in pitch toward its butt end, the throats also gradually increasing in depth from the point to the butt end.

LUBRICATOR.—William A. Seibel, Independence, Iowa. This in an improvement on a formerly patented invention of the same inventor, and provides for conveniently lubricating parts of elevated machines without waste of oil and while elevating and moving the can. According to this improvement, the bail of the oil can is engaged by a cord passing over a pulley at an elevated point above where the oil is to be applied, there being also a projection on the part to be lubricated adapted for engagement with a hook on the oil can spout, so that, as the can is raised, it will be tilted to permit the oil to flow through the nozzle to the part to be lubricated. The invention is especially applicable for oiling the running parts of a windmill.

ELEVATING AND DUMPING DEVICE.—Louis E. Hoy, Fremont, Neb., and Harman Hoy, Baltimore, Md. This is an improvement on formerly patented devices of the same inventors for elevating and dumping the boxes of wagons, cars, and other vehicles, and provides simple means for holding the running gear of the vehicle in place while the box is automatically locked by the elevating device, and raised, dumped, and lowered to its original position. A framework has a track by which the vehicle is guided to proper position, while movable in the framework is an open bottom cage provided with spring-actuated means to engage and lock the bed of the vehicle, and pivoted to the upper part of the frame is a chute adapted to receive the contents of the cage when it is dumped.

Mining, Etc.

CONCENTRATOR.—Reuben D. Woodward and Willard C. Brown, Leadville, Col. For separating the precious metals from sand, gravel, etc., these inventors have devised a simple and inexpensive machine, to be operated with a minimum of power and requiring but little water. In a suitable frame an inclined shaking trough is held, to the upper end of which water is admitted, the material being shoveled in. The trough has screens by which the coarser matters are separated and thrown out, while through a screened hopper beneath the finer particles are passed to a semi-cylindrical rocking amalgamator, in the bottom of which is a quantity of mercury, and in which revolve knives to stir up the material.

Agricultural.

SEED PLANTER AND CULTIVATOR.—Vinson V. Hill and March Holman, Norwood, Ga. This invention provides a machine to be operated by a spring motor, dispensing with the use of horses. When used as a cultivator the seed box and covering roller are detached and a gang of cultivator teeth and a seat, if desired, are attached to the machine. A little distance back of a front caster wheel is a main running wheel, to the axle of which power is applied by a set of gears from a spring motor, wound up by a key. Within the seed box is a stirrer revolved from one of the gear wheels, and the driving mechanism is readily thrown out of gear.

STUMP PULLER.—Alfred S. Oberson, Westby, Wis. This is a strong, easily operated machine, so built that the winch cannot fly backward, should the harness at the connection between the horse and the winding sweep be broken when there is a heavy strain on the pulling cable. On a suitable base are uprights supporting a head plate, and affording a bearing for a vertical shaft on which is a ratchet wheel adapted for engagement by a pawl, while a winch rotating on a shaft has a bearing through the head block, a sweep arm to which a lever is pivoted extending horizontally from the upper end of the shaft, and a ratchet wheel on the winch being adapted for engagement by the lever.

Miscellaneous.

BICYCLE.—John C. Raymond, New York City. This is a machine designed to utilize the strength of both arms and legs in its propulsion, affording a more natural position of the body in working the machine and insuring a more uniform development of the muscles. The treadles are connected with pitmen by which the drive wheel gears are operated, and levers connected with the handle bar can also be connected with pitmen for the propulsion of the wheel, the handle bar being worked back and forth for this purpose, and the steering being effected by rocking the handle bars up and down. The machine is adapted for use by both ladies and gentlemen.

VELOCIPEDE SPRING MOTOR.—Martin J. McDonald, Trenton, N. J. This is a mechanism for accumulating surplus power in descending a grade, and storing such power, to be subsequently applied to the propulsion of the machine, the mechanism being contained in a frame which may be attached to the frame of the machine by clips. The power is received and stored by helical springs connected to and wound on a shaft journaled in the frame, the direction of movement to and from the springs being governed by adjustable gearing and clutch mechanism, that the motor may accumulate or give out power.

DRY DOCK.—John W. Boggs and Archibald Cameron, Portland, Oregon. This dock has at one end a sliding gate for opening and closing the inlet to a front dock chamber, at the rear of which is the dry dock proper at a higher level. The gate is adapted to slide into a chamber at one side of the front dock chamber at its entrance, and is adapted to hold water in its interior by which the gate is forced downward, the gate having packing strips for forming water-tight joints between it and the posts and the bottom of the dock chamber, and the gate and posts also carrying devices for compressing the strips when the gate is closed.

LABELING MACHINE.—Herbert Rawlinson, San Francisco, Cal. This is a machine for automatically attaching a label or wrapper to circular bodies as they roll down an incline, a paste-supplying cylinder imparting paste to the rolling body, and the label, as it is rolled up on its periphery, being closely and firmly pressed in place. One body after another is fed at the upper end of the guideway on to a stop wheel, which automatically releases the bodies in succession during the continuous operation of the machine.

AQUATIC EXERCISING APPARATUS.—George C. Tilyou, Brooklyn, N. Y., and Jean M. A. Lacomme, New York City. This is an apparatus for use at a seaside or other watering place, or at a river bank, to facilitate taking baths by persons of all ages and sexes, without danger or inconvenience, promoting also the taking of hygienic exercises and learning to swim, etc. The invention consists primarily of a column or post placed at a suitable distance out in the water and having at its top a horizontal revolving wheel which supports sheaves and hanging ropes or cables at whose ends are eyes or rings, or a swimming belt, whereby bathers may be supported as desired in the water, or a boat may be attached and carried around by the revolutions of the wheel.

FISHING ROD SUPPORT.—Jacob A. Eicher, Trenton, Ill. In the top of a stake which may be easily driven into the ground on the banks of a stream or other place for fishing, is pivoted a curved cradle which has at its inner end a socket to receive the inner end of a fishing rod and at its outer end a groove in which the rod may lie. Pivoted to the inner end of the cradle is a toothed segmental latch bar, passed through a slot in the stake, and adapted to engage a pin therein, the latch bar sliding freely through the slot when, by depressing its rear end, the pole is to be raised, but engaging the pin to hold the pole at any desired angle over the water, and leaving the fisherman at liberty when the fish are not biting freely.

MUSICAL INSTRUMENT.—Prof. F. P. Cericola, No. 386 Thirteenth Street, Brooklyn, N. Y. This invention provides a new mechanism for organs, pianos, and organettes using music rolls for automatic playing, or perforated strips of paper fed over a barrel and having perforations coinciding with ducts in the barrel. At present the roll can only be played once without being re-suspended, but according to this improvement the roll can be folded and unfolded back automatically as it is played, permitting each piece of music to be repeated as desired, and keeping the same time, rendering the instrument of great utility for ball rooms, dancing schools, theaters, churches, etc. The instrument is preferably furnished with three music rolls, each having twenty or thirty pieces of music of different classes.

PEN HOLDER.—Hiram S. Rumfield, Salt Lake City, Utah. The body of this holder is much shorter than is usual, and is tubular, a spring-pressed sleeve sliding in the body, which is adjustably connected with the sleeve. The outer end of this sleeve, when the holder is in use, bears and is pressed against the fleshy inside part of the hand at the base of the thumb and forefinger. The pen holder sections reciprocate one on the other in the act of writing, and, after one has become used to this changed method of using a pen, the improvement is designed to afford greater ease in writing, lessening the fatigue of the thumb, fingers and hand.

DENTAL FLOSS HOLDER.—John D. Cutter, Brooklyn, N. Y. To hold floss conveniently for tooth cleaning purposes, this inventor has devised a frame consisting of a single strip of wire bent to form a handle portion and two outwardly extended flared portions, each provided with a transverse kerf, a bobbin being removably supported in the handle portion of the frame. By means of this simple and inexpensive device a small stretch of floss or similar material may be rigidly held in position to be easily inserted between the teeth.

LAMP BURNER.—Hartwell A. Crosby, Calais, Me. This is a simple form of burner in which the lamp wick may be conveniently trimmed and the flame extinguished by merely actuating the device to lower the wick. Within the wick tube is a wick-raising shaft carrying a spur wheel or disk, and this spur wheel or disk, when the wick is lowered, engages a pivotally mounted trimming plate which plays edgewise across the open end of the wick tube, to remove the crust or charred portion of the wick.

GATE.—John H. Johnson, Silverton, Oregon. This gate is centrally pivoted on lifting levers and adapted to travel between guide posts at one side of the road, pull ropes being attached to the central portion of a balance rope or link and carried over guides to opposite sides of the gate. In opening or closing the gate one of the two ropes is pulled downward, when the end of the gate farthest from the guide posts is first raised, the gate being carried through the guide posts as it is lifted, to either open or closed position.

GATE.—John F. Ferris and Warren M. Thomas, North English, Iowa. This is an improvement on a formerly patented invention of the same inventors, and provides a gate which is pivoted at its lower inside corner only, between two posts, by means of a strap on the bottom of the gate, the pivotal bolt being of such length that the gate has a small movement up and down on it. One of the main gate posts and another post the distance of the length of the gate to one side carry the mechanism of levers and connecting cords, with pull handles on each side, by means of which the gate may be readily opened and closed, the design being that the entire construction shall be simple and inexpensive and not liable to get out of order.

WIRE STAY WEAVING DEVICE.—Enos F. St. John, Highland Station, Mich. This is a simple tool where by a strand of wire of any size coil

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wire may be woven or coiled about fence wires to form a stay for them, the wire being drawn directly from the coil as it is applied to the fence wires in position. The frame of the device forms practically a double crank, thus obviating the necessity of the operator passing his hand through parallel fence wires to grasp and turn it, and the stay wire freely leaves the post on which it is coiled without liability to become tangled up with the frame.

POST DRIVER.—Robbert G. Work, Marion Center, Pa. This is a portable post driver adapted to be mounted on a wagon bed, at the rear end of which the falling weight, or "monkey," is guided between vertical standards. The cable for raising the weight passes over a pulley depending from a cross beam and is attached to a winding drum on a splined shaft, the drum engaging the spline on the shaft to be wound up and lift the weight, and being withdrawn from the spline to permit the fall of the weight. Between the vertical standards are transverse guides or supports adapted to steady large or small posts in position for driving.

HORSE FLY NET AND COVER.—Henry C. Carter, Belmont, N. Y. This is a net which is made in sections, there being a head piece or bridle section located at each side of the neck, a breast piece or collar section, and a back piece having two side members, the frame of each section being made of spring wire bent to proper contour and having hooks or loops to facilitate attaching the netting in position. The netting consists of pendent strips or a fringe attached to a hem through which a portion of the wire of each frame section is passed. This net is designed to permit a free circulation of air around the body of the animal, and is readily attached to the harness.

REIN GUARD.—Thomas Thompson, New London, Wis. To prevent the reins from catching beneath the ends of the thills of a vehicle, this inventor provides a guard of flexible material, such as a leather strap, to pass across the breast and connect the ends of the thills, the guard being attached to sleeves which fit on the ends of the shafts. This arrangement also prevents the horse from catching a shaft around a post, and prevents the ends of either shaft from being run into another horse in case of collision.

THILL COUPLING.—Charles W. Goble, Canyon, Col. This is a coupling designed to facilitate changing from a thill to a pole, or vice versa, as desired, and one requiring no bure, the head of the coupling pin also being concealed, and no portion of the device being liable to produce rattling. The base plate is clipped to the axle and has forwardly extending jaws, one with a recess in which fits the head of the pin, held in position by a slide, while a spring is formed with opposing shoes which engage the lower portion of the slide ways and lock the pin in position.

SASH FASTENER.—Joseph L. Bossler, Alton, Ill. According to this improvement a latch is attached to the upper rail of the lower sash and a keeper is secured on the upper face of the lower rail of the upper sash, the latch having an angular post with pendent finger adapted to engage a slot in the keeper through which is passed a spring latch bar. The device is simple and inexpensive, automatically locking the window in closed position, while the unlocking is readily effected from within the room.

LOCK.—John Alfors, Hanna, Wyoming. This lock is adapted for use in doors, drawers, etc., where the knobs are fixed to the casing, a key being introduced into either of the knobs instead of into the body of the lock for returning or unlocking the bolt, the construction of the lock being such that when the key is withdrawn the bolt automatically assumes a locked position. The lock bolt is withdrawn by the pressing of a tubular key inward in a tube of the knob, the pressing of the key fully inward holding the bolt permanently back, so that the door may be closed without locking.

DOOR CATCH.—Peter Mickelson, Cedar Valley, Iowa. This is a cheap and simple device especially adapted for use in connection with barn doors, preventing the wind blowing the door closed or against a team. It has a base plate for attachment to the building at the proper distance behind the door, and supporting spring wire holding arms which rock on the plate, and are adapted to close upon the edge of a door when it is opened wide and hold it in open position until the locking arm of the catch is purposely moved outward.

FLOUR AND MEAL BIN AND SIFTER.—Charles P Alexander, Cleburne, Texas. This is a combination piece of kitchen furniture in which are two bins and a chamber below in which is a sieve adapted to be reciprocated, means being provided whereby any desired quantity of flour or meal may be delivered to the sifter, the latter being readily removed for cleaning. The sieve is given an intermittent reciprocating movement by a cam operated by a crank and a chute delivers the sifted material to a suitable receptacle.

LOCK FOR STOP COCKS.—Albert T. Patrick, New York City. To temporarily or permanently lock the turn key of an ordinary stop cock this inventor has devised a simple and easily applied and removed device, consisting of a slotted hasp adapted to be passed around the stop cock and engage with its slot the turn key, the free ends of the hasp being then locked by a padlock. The device is designed for use on supply pipes at meters and elsewhere, where it is desired to cut off the supply without removing the meters or disturbing the fixtures.

NON-REFILLABLE BOTTLE.—Enos C. Pollard, Holt, Montana. To prevent the refilling of bottles and their re use as original packages, this inventor has devised a bottle of which a portion must be broken off before the contents can be discharged. The neck is made with an integral sealing extension on which a trade mark may be placed, a groove being formed at the junction of the neck and extension to facilitate breaking off the latter. After the liquor has been placed in the bottle a cork is forced into position in the neck below the extension, and a suitable cement placed on the cork, there being embedded in the cement a glass stopper with flared lower end and flanged top, fitting in the top of the extension.

BADGE BUTTONS.—James H. Patterson, Martinsville, Ind. This is a button to be worn in the lapel of the coat to furnish amusement in answer to threadbare and tiresome comments about the weather. It has a front plate, with a cut-out quarter section, beneath which is a revoluble plate divided into quarter sections, the front plate bearing the words "Yes; it is," and the revoluble plate having on each of the quarter sections one of the following: "hot," "cold," "wet," "O. K.," so that by turning the under plate a definite answer is given by the button to ordinary remarks about the weather.

WAIST BELT.—John F. Schotz, New York City. This is a ladies' belt, designed to be worn with comfort while it is also adapted to contract the figure at the junction of the hips with the waist, to lengthen the waist. At each side of the belt is a pocket in which is a spring, reinforced on its inner face by an added strip of spring material of lozenge or diamond shape, the two springs being so connected that they will adapt themselves to the curvature of the body. The belt is adapted to be worn over the corset, and is designed to accomplish what cannot be obtained by the use of a corset, no matter how tightly the latter may be laced.

TRAY ATTACHMENT FOR BEDSTEADS.—Ella F. Fry, Richmond Dale, Ohio. To hold articles for the convenient use of invalids while confined to their beds, this inventor provides a novel device that is readily attachable to the inner face of the side rail of the bedstead, being foldable adjacent to the mattress. A post is pivotally attached to the rail, and adjustable thereon is a standard carrying a hinged bracket plate to which a tray may be secured and held in level position, partly over the bed, the occupant of which is thus enabled to eat with comfort and have the necessary articles within easy reach.

COAL RECEPTACLE AND ASH SIFTER.—Adolph J. Smith, New York City. In a suitable casing, according to this improvement, is a top compartment adapted to receive an ordinary coal pail or scuttle, containing the coal supply, and in the upper front portion of the casing is a downwardly swinging door, allowing coal to be sifted to be poured in upon a downwardly and rearwardly inclined screen through which the ashes pass to a pan beneath, while the cinders are directed to an inclined chute leading to a lower drawer in the bottom of the casing.

SPITTOON.—Richard J. Smith, Lovelaceville, Ky. This is a spittoon to be secured in the floor, and especially adapted for use on railroad and street cars, boats, etc. It has a cylindrical body, with top flange resting on the floor around the opening in which the spittoon is set, and has a hinged cover connected by a chain with a bottom swinging cover. When the top cover is raised and thrown back, which may be readily done by the foot, the bottom opening is closed, and when the top cover is closed the bottom cover swings downward and the contents are discharged.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 10 cents each. Please send name of the patentee, title of invention, and date of this paper

NEW BOOKS AND PUBLICATIONS.

UNCLE SAM'S LETTERS ON PHRENOLOGY. New York: Fowler & Wells Company. Pp. 154. Price 50 cents.

This is a little work originally published in 1842, and, being thought too good to be lost, is now presented in revised form. The letters were written by a Presbyterian minister, and treat with considerable discrimination of the advantages of phrenology.

PRACTICAL GUIDE FOR FIREMEN. By W. H. Wakeman. Bridgeport, Conn.: American Industrial Publishing Company. Pp. 74.

This is a little handbook of instructions and suggestions for the care and management of steam boilers, pumps, injectors, etc.

IOWA GEOLOGICAL SURVEY. Volume V. Annual Report, 1895, with accompanying papers. Samuel Calvin State Geologist, H. Foster Bain Assistant State Geologist. Des Moines: Published for the Iowa Geological Survey. 1896. Pp. 452.

This very excellently reproduced geological report is devoted to the geology of six counties of Iowa. It is published by the Geological Board of the State, which consists of the governor and auditor and three other members, Samuel Calvin being the State geologist. It is very finely printed, and will find naturally a place in colleges and geological libraries.

TWENTIETH YEAR BOOK OF THE NEW YORK STATE REFORMATORY FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1895. With illustrations and anthropometric tables. Elmira, N. Y. 1896.

This report is, it appears to us, too short for the ground it covers. Its topics are of the deepest interest and are most excellently treated, except for their briefness. The study of criminal statistics, the accumulation of data, the influence of heredity and of association upon character, the physical traits of the class of humanity who have an enforced seclusion in Elmira reformatory, are the topics which the report covers. The institution was, by some recent investigations, brought somewhat prominently before the public. It seems to have survived the criticisms then excited. Two papers, one on the School of Letters, by the late Prof. James R. Monks, the other, "Observations and Notes," by Dr. H. D. Wey, are particularly to be commended, as are also the excellently selected illustrations.

We have received from F. A. Bradley, of New Haven, Conn., a handsome binder or temporary cover adapted to conveniently hold the numbers of the SCIENTIFIC AMERICAN as they are successively published. It has a Russia leather back and is carefully made by hand, promising to do excellent service in everyday use.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(6954) D. C. T. McM. writes: I found a common toad endeavoring to make his escape from some pursuers. I saw also one of his hind legs dragging, and merely hanging by the tendons and ligaments of the second joint. I was astonished to see a black bug seize hold of the toad at the seat of the wound. He now got a secure hold on his victim. The frog was exhausted and demoralized. It (the bug) seemed to be a black beetle, such as live in decayed stumps and rotten timber. Does your entomologist know such propensities in any kind of beetle, Coleoptera or Scarabæus? I rescued his frogship from his savage assailant, when he made his escape with his foot dangling. Please let me know if such an attack from a bug on such a large victim is common. A. The United States Department of Agriculture says: In the accompanying letter Dr. C. T. McMannen, of White Springs, Florida, refers undoubtedly to one of the large predaceous ground beetles, and probably to the species known as Pasimachus strenuus. This beetle feeds on all sorts of animal matter, including living insects and the dead bodies of larger animals. I cannot say that I have heard of exactly such an occurrence as that described by your correspondent. From the habits of the insect, however, this is not at all unlikely to have occurred, and the observation is a very interesting one.

(6955) E. B. O. writes: I have a telephone plant built with a common return wire, but haven't it grounded. To ground it in the city I get too much noise on the lines, caused by the electric street car lines and electric light plant having lines grounded. Now, I have a subscriber living three miles east of the city and one living three miles west. I was thinking of grounding the return wires at these two points. How would it act? Would it make more or less cross talk on the lines? A. You will have to try it. Possibly no return wire will be needed. 2. What wires on a telephone switchboard should be German silver and what ones copper, and why? A. Make all connections with copper wire. 3. How do you measure the ohms in an induction coil the number? A. By the Wheatstone bridge. 4. Which is the best for a common return wire, bare or insulated, No. 12 copper or No. 6 copper for an exchange of 300? A. Use copper wire, the larger the better, not necessarily insulated.

(6956) J. G. K. says: Will you please give through the columns of the SCIENTIFIC AMERICAN a formula for making Japan ink, such as is used by many of the professional penmen? A. 1. Take of Aleppo galls, ½ pound; logwood chips and copperas, each ¼ pound; gum arabic, 3 ounces; sugar, 1 ounce; sulphate of copper, ½ ounce; sugar candy, ½ ounce. Put the galls and logwood in 6 quarts water. Boil slowly until the water is reduced in volume one-half. Strain through cotton flannel, and add the other ingredients. Keeping the solution warm, stir until all the ingredients added are dissolved. It should then be placed in a deep glass vessel and allowed to settle. The ink may be removed from the settlings by pouring off carefully, or using a siphon. The gloss of the ink may be increased or diminished by increasing or diminishing the amount of gum used in the recipe. If carbolic acid be added until its odor is just perceptible, it will prevent moulding. Oil of cloves added will also effect the same result, and it gives the ink a less offensive odor. 2. Dissolve in ½ pint soft water ⅜ ounce of potassium bichromate, and add the solution to 6 ounces of logwood extract, dissolved in 1 gallon of water; then dissolve in 1 gallon water by continued boiling, borax, 6 ounces; shellac, 1½ ounces. Mix all together while warm and add 3 ounces of ammonia.

TO INVENTORS.

An experience of nearly fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

September 1, 1896,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Advertising device, S. B. Hosmer 566,761
Air brake, D. Dunn 567,024
Air compressors, inlet valve for, R. F. Grigsby 567,092
Air valve, automatically opening or closing, F. J. Gubelman 567,093
Alarm. See Boiler pressure indicating alarm.
Animal trap, J. W. Jones 566,912
Ant trap, P. H. Brown 567,076
Bag holder, G. Strong 566,809
Baling press, hand, M. Forder 566,976
Battery plate, secondary voltaic, J. G. A. Rohdin. 567,044, 567,045
Bearing, ball, P. F. Turner 567,013
Bed and couch, combined folding, F. D. Swaney 566,813
Bed, spring, G. Mafera 566,781
Bedstead clamp, screw eye, R. F. Clark 566,742
Beehive, N. C. Kelso 566,913
Beer fountain, steam, W. H. Smyth 566,942
Bicycle, H. L. Boyle 566,838
Bicycle, J. C. Raymond 567,042
Bicycle crank axle, F. J. Grodavent 566,906
Bicycle frame, C. L. Houghton 566,861
Bicycle handle bar, B. Porter 566,794
Bicycle support, A. Lucas 567,035
Bicycle support, R. G. Wells 567,015
Bin. See Flour and meal bin.
Bit. See Bridle bit.
Block. See Tackle block.
Boat. See Life boat.
Boiler. See Water tube boiler.
Boiler flue cleaner, W. H. Howe 566,763
Boiler furnace, P. H. Bagley 566,837
Boiler furnace, steam, O. F. Jones 566,967
Boiler pressure indicating alarm, D. C. McAulay 566,995
Bookcase, W. M. Poindexter 567,003
Books, forms or the like, indicator for, J. Speyer 566,943
Booth, degree, N. H. Reynolds 566,799
Boring and mortising machine, gang bit, E. B. Hayes 567,027
Bottle, Axford & Lambertson 566,733
Bottle, K. A. Klose 567,103
Bottle, W. H. B. Schmied 566,873
Bottle, non-refillable, Depro & Baker 567,081
Box cover machine, B. M. Gunston 567,094
Box machine, Van Vleet & Osborne 566,823
Bracket. See Hose bracket.
Brake. See Air brake. Car brake.
Bridge guard, T. H. Andrew 566,960
Bridle, J. A. Reils 566,798
Bridle bit, H. G. Leisenring 567,033
Broom or mop holder, J. W. McIlhany 566,787
Buckle, I. D. Wright 567,061
Button making machine, F. J. Kaspar 567,102
Calculator, yardstick, E. Praeger 566,867
Can. See Sheet metal can.
Car brake, W. H. Tallman 566,814
Car brake, electric, A. B. Roney 566,939
Car coupling, J. Farlow 566,749
Car coupling, J. F. Hay 566,907
Car coupling, J. D. Majors 566,991
Car coupling, T. J. Orr 567,109
Car coupling, W. G. Smith 566,876
Car coupling, W. T. Van Dorn 566,822
Car, dumping, M. F. Blake 567,019
Car fender, J. R. Thomas 566,879
Car heating apparatus, E. E. Gold 566,904
Car wheels in place, apparatus for grinding, N. Casey 566,891
Cars, magnetic traction apparatus for motor, W. Robinson 566,800
Carriage, J. A. McLean 566,790, 566,791
Cartridge primer, N. G. Whitmore 567,114
Case. See Bookcase. Extension case. Toilet case.
Cash register and indicator, G. L. Barnes 567,066
Cash register and indicator, E. T. Taylor 566,878
Centrifugal separator, W. E. Simonds 566,807
Chain, adjustable drag, J. H. Mitchell 566,995
Chair. See Shoulder and back bracing chair.
Chair leg strengthening device, H. Geise 566,979
Chuck, drill, A. D. Goodell 566,905
Chuck for hollow ware, A. R. Pritchard 567,004
Churn, J. F. Baugh 567,018
Cigarette packing machine, Van Vleet & Hurd 567,014
Clamp. See Bedstead clamp.
Cleaner. See Boiler flue cleaner. Dust collector cleaner. Shell cleaner.
Clock, musical, W. H. Wright 566,956
Cloth sponging and refinishing apparatus, D. J. Stein 567,111
Coal lifting implement, Fitzgerald & Thomas 567,087
Coat and hat hook, J. F. Bearinger, Jr 566,962
Coat lock, G. K. Florer 566,852
Coating apparatus, metal, Thomas & Davies 566,880
Cock lock, stop, A. T. Patrick 566,982
Composition of matter for building purposes, Woltersdorf & Angus 566,833
Concentrator, Woodward & Brown 566,834
Cooker, steam, A. M. Amos 566,884
Copyist's line marker, L. H. Miller 566,864
Corset, A. Grassmann 567,027
Coupling. See Car coupling. Pipe coupling. Shaft coupling. Thill coupling.
Cover, saucepan, G. Curley 566,744
Crayon or pencil, A. K. Cross 566,845
Cutter head, G. H. Rice 567,046
Damper, stovepipe, H. L. Ferris 567,025
Dandy roll frame, H. E. Wambold 566,825
Dentalarticulator, W. E. Walker 566,949, 566,950
Dentalfacial clinometer, W. E. Walker 566,948
Die, Kelsey & Dunham 567,030
Display box cover, G. M. Hudson 566,765
Dock, dry, Boggs & Cameron 566,734
Door catch, P. Mickelson 567,036
Draught rigging, W. M. Piper 566,935
Draught screen, C. Y. Taylor 566, 158
Drill. See Well drill.
Drills, machine for making twist, E. E. Claussen 566,966
Drills, rotary support for, W. J. Mewer 566,923
Drying materials, method of and apparatus for, H. W. Rappleye 566,797
Dust collector, A. C. Brantingham 566,737
Dust collector cleaner, F. G. Gauntt 566,978
Edge finishing machine, S. D. Tripp 566,819
Electric distribution machine, W. E. Sinclair 566,874
Electric heater, F. L. Pruyn 566,795
Electric light hanger, J. F. Diehl et al 567,022
Electric motor, J. Bram 566,889
Electric motor, R. Eickemeyer 567,119
Electric motors, automatic starter for, J. E. Putnam 566,936
Electric selector, A. Le Blanc 566,914, 566,915
Electric switch, J. L. Hornig 566,760
Electrical communication, J. A. Sullivan 567,112
Electrical construction, regulation and distribution, T. H. Hicks 566,860
Electrical selecting instrument, A. Duppler 566,896
Electrical transmitting instrument, A. Le Blanc 566,917
Electromagnet, A. Le Blanc 566,918
Elevating and dumping device, L. E. & H. Hoy 567,100
Elevator, C. A. Harkness 567,095
Elevator door operating apparatus, Burdett & Rowntree 566,839, 566,840
Elevator indicator, J. N. Strong 567,012
Elevator valve, W. H. Hultgren 566,982
Embroidery frame, H. F. Blackstone 567,070
Emery or other abrasive wheels, mounting, Alden & Higgins 566,883
Emery wheel truing machine, Higgins & Alden 566,908
Engine. See Hot air engine. Rotary engine. Traction engine.
Exercising apparatus, aquatic, Tilyou & Lacomme 567,056
Extension case, N. Goldberg 567,026
Eyelets, device for finishing covered, A. C. Estabrook 566,850
Feed boxes, automatic attachment for, C. S. Locke 566,778
Fence, M. Neil 566,792
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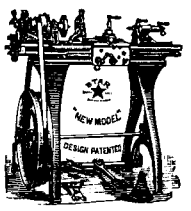

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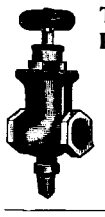

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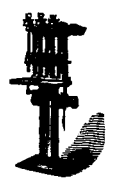

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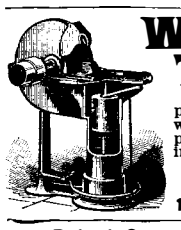

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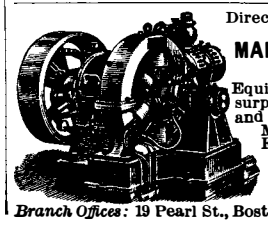

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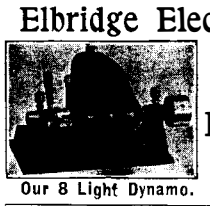

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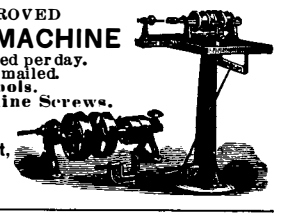

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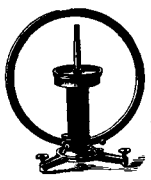

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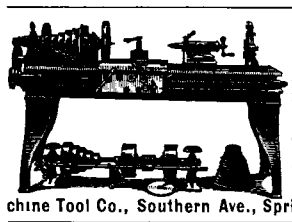

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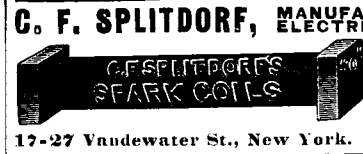

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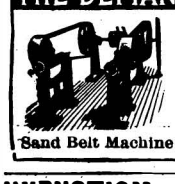

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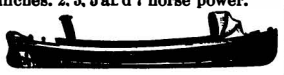

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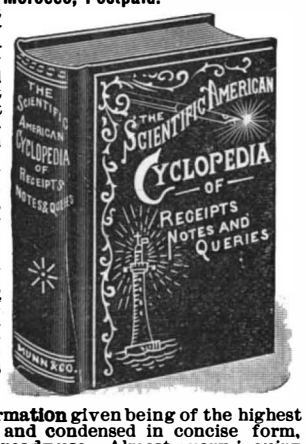

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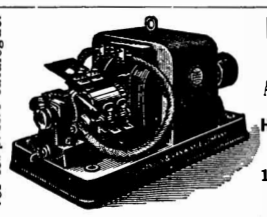

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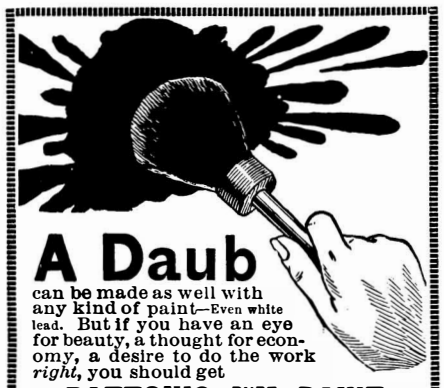

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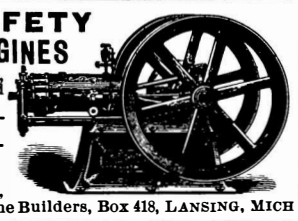

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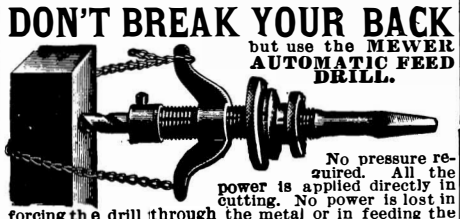

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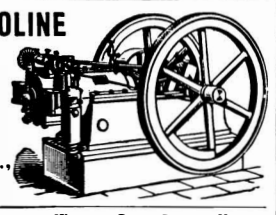

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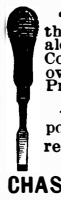

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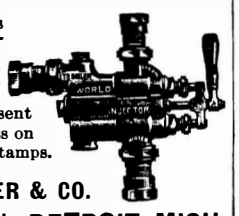

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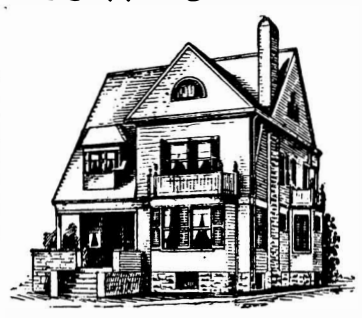

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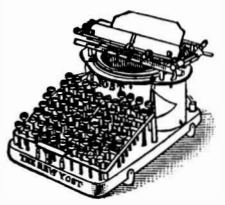

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